

# Exploring Agile Supply Chains for Creating Innovative Products Closer to the End-user

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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## **Statement of Authorship**

I certify that, except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; I acknowledge the editing work completed in this thesis by Elite Editing; and, ethics procedures and guidelines have been followed.

Andrea Gyarmathy

17 May 2018

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## **Dedication**

I dedicate this thesis to my husband, two sons, parents and siblings, and especially offer my heartfelt dedication and thanks to my beloved late mother, Kiss Eszter Lenke, for her unconditional love and sacrifices. She raised me with good cultural values and shared her experiences to help me face this challenging life.

Primarily, I dedicate this thesis to my husband, Attila, who encouraged me and assisted my PhD journey to make it viable. He enabled me to raise our family with an extra ‘project’ that triggered my interest to complete this study within the area of supply chain management and operation.

To my dearest sons, Aron and Donat, I hope that this thesis may inspire you to excel in any field in which you venture during your life journey.

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## **List of Abbreviations**

3PL	Third-party Logistics
CPFR	Collaborative Planning, Forecasting and Replenishment
DC	Dynamic Capabilities
EDI	Electronic Data Interchange
GDP	Gross Domestic Product
JIT	Just-in-time
PFMF	Porter's Five Market Forces
R&D	Research and Development
RBV	Resource-based View
SCOR	Supply Chain Operations Reference
TCA	Transaction Cost Analysis
TCO	Total Cost of Ownership
US	United States

## **Publications**

### **Conference Paper**

The 18th International Symposium on Logistics (ISL 2014), 7–10 July 2014, Vienna, Austria (awarded for publishing in a journal paper, but work has not completed yet).

## Abstract

**Purpose:** The purpose of this research is to present a conceptual model of a viable onshore agile supply chain approach for innovative product manufacturers in the Australian manufacturing sector. As such, this study provides insight into the drawbacks of offshore manufacturing and an empirical investigation into the importance of the Australian manufacturing sector. This study aims to answer the research question: how can agile supply chain management add value to the Australian manufacturing to create innovative products closer to the end-user?

**Design/methodology/approach:** This study develops and examines a theoretical framework through a qualitative methodology using interviews, and the results are validated with an online survey. The aim of the research is to demonstrate the theoretical framework of effective onshore manufacturing. Dynamic capabilities theory and total cost of ownership are applied to investigate the research question. This research presents a theoretical framework with the main elements of agility, adaptability, responsive supply chain, strategic flexibility, onshore manufacturing and total cost of ownership analysis.

**Findings:** From the literature and theoretical perspective, this study proposes that, in an innovative sector, which should apply an agile supply chain, onshore manufacturing or local sourcing is the optimal and most effective solution. Further, the findings of the study enrich the discourse on strategic agile management by supporting the view that dynamic capabilities and resources enable firms to achieve sustainable competitive advantage.

**Originality/value:** Although studies in the agile supply chain area have examined competitiveness from several perspectives, there has been little to no research focusing on the advantages of agile onshore supply chain solutions. This research notably widens the theoretical perspective of agility and adaptability for innovative product manufacturers in the Australian manufacturing sector, and the viability of remaining onshore.

**Keywords:** agile supply chain, onshore manufacturing, local sourcing, agile management, strategic flexibility, responsive supply chain, dynamic capabilities, total cost of ownership

# **Chapter 1: Introduction**

## **1.1 Research Overview**

The study explores how flexible supply chain activities can add value to onshore manufacturing operations among Australian manufacturers of innovative products to potentially gain competitive advantage. During the last five years, with volatility in the business environment increasing significantly (Candace et al. 2011; Christopher et al., 2011), the concept of a local sourcing strategy and onshore manufacturing has been one of the components of a flexible supply chain among Australian manufacturers with innovative products (Georgiadis et al., 2011, Fantazy et al., 2012). This strategy provides rapid customer response and increases final value by modifying the production process for the purpose of gaining competitive advantage (Abdulla 2009; Butner 2010; Christopher and Holweg 2011) .

The intention of this research is to explore the advantage of manufacturing closer to the market, and implementing flexible supply chain management for manufacturers with innovative products. In other words, this study compares the supply chain activities and effectiveness of Australian firms that use lean, agile and local sourcing strategies and firms that apply a global sourcing strategy or offshore manufacturing, as well as how these firms add value throughout their supply chain.

According to the Australian Bureau of Statistics (2014), although the manufacturing sector is the fourth-largest employing industry in Australia, employment declined by 7.2% over the 10 years to February 2014. While offshoring is a good strategy for lowering costs and prices for the end customer, there are inefficiencies created by the shift to local sourcing, such as less flexibility and a slower response to changing customer demands (GT 2011; Holweg et al., 2011; The Economist 2012). A recent trend in Europe and the United States (US) is to remove outsourcing and return to local sourcing (Eurofound 2017, MH&L 2017). Therefore, for Australian manufacturers to improve flexibility in the supply chain and improve customer response times, research needs to be undertaken to determine whether

onshore manufacturing with agile supply chain management is a viable strategy among manufacturers with innovative product.

A search of the academic literature discussing local sourcing in the flexible supply chain context in Australia yielded no significant results in this specific area of this research. There are several articles related to this the topic; however, these are mainly from authors in the US and Europe. However, in July 2012, the Australian Government issued a taskforce (DIISRTE 2012) to highlight the decline of the number of Australian manufacturers; raise awareness about the Australian manufacturing sector; and call for experts, researchers and political members to help Australian manufacturers improve their capabilities and possibilities. This highlights the importance and need for this type of research.

Environmental uncertainties, volatile economic situations around the world, a fast-moving business environment and customer demand create the need for a quick response to end-users, which requires agile supply chain solutions (Christopher and Holweg, 2011). To achieve competitive advantage, manufacturers may need to reconsider their operations and to manufacture or source their products closer to the end-user. There are a growing number of examples (Chaudhry and Hodge 2012; Cooper et al. 1997; Lau and Lee 2000; Georgiadis et al. 2011; Stavroulaki & Davis 2010; Sharma 2010) of individual businesses that no longer operate separately, but as a supply chain. For this reason, this study examines this concept as an overall supply chain-related problem, rather than a single business issue.

As the literature indicates, making the decision to move offshore or outsource production to overseas comes with the intention to increase firms' possibilities, including increased market existence, technology, source and workforce possibility (Christopher et al. 2011). However, this also creates risk in terms of the smooth and stable operation of firms (Christopher et al. 2011).

## **1.2 Research Background**

After reviewing similar studies and publications in published journals about supply chain management, management strategies, manufacturing, operations and outsourcing,



increasing numbers of publications were found concerning the debate about the reshoring and backshoring phenomenon around the world, which is an interesting and contrasting topic in an era when increasing numbers of Australian manufacturers are deciding to move production to low-cost countries.

Australia has recently lost its car manufacturing industry, which had more than 70 years of presence and history in Australia (Dowling 2017; Ladd 2017). Moreover, over the last two decades, vast amounts of Australian manufacturers have decided to move their production sites overseas, as they relocate their manufacturing mainly to low-labour-cost Asian countries (Feil 2012; Thorp 2012). As with the recent closure of the Australian car manufacturing industry, other manufacturing sectors have had similar reasons to close and move their production overseas. According to different sources (AFR 2013; Green 2017; Ladd 2017), there are four main reasons for the manufacturing sector downturn: (i) the lowering of import tariffs and the signing of free trade agreements, (ii) higher wages and better work conditions demanded by Australian unions, (iii) the appreciation of the Australian dollar and (iv) difficulty competing when labour costs in some Asian countries are only one-fourth of those in Australia (Ladd 2017).

In contrast to the above facts, several Australian manufacturers still have viable production and profits within the internal border (Swarbrick 2007). The above controversial statements raise questions about which type of manufacturers can remain in Australia, and whether the involvement of supply chain management and agile supply chain management can assist business success and maintain the viability of manufacturing in Australia.

The production of mass-manufactured goods and some high-tech goods has moved steadily to Asia over the two last decade because of the reasons mentioned above. However, for managers of global supply chains, the question now is whether to consider scaling back offshore production by returning operations to be closer to the end-user. In rethinking global supply chains, companies must carefully evaluate the importance of speed, the availability of skilled talent, the potential for further productivity gains in Asia, one-time transition costs, the local import and tax implications, and organisational interfaces (Borkes 2013; Butner 2010; Candace et al. 2011; Ellram, 2013).

### **1.3 Research Objective and Question**

The objective of this research is to determine whether there is any particular type of manufacturer that can stay local and whether agile supply chains add value to those manufacturers that decide to stay onshore. This research explores the viability of a theoretical framework for onshore strategic agility when making decisions about onshore or offshore manufacturing operation of Australian manufacturers. Furthermore, this study explores how agile supply chain management assists in creating value-added innovative products closer to the end-users.

Global sourcing strategies were one of the greatest emerging management trends in the last 20 years (Butner 2010). Initially, global sourcing was used for 'in-house' operations, such as supplying production with materials or goods from overseas. This direction seems to be effective and offers organisations the possibility to achieve a competitive advantage. However, during the last 10 years, global economic uncertainty and volatility have weakened the benefits of global sourcing as greater risks appear (Butner 2010; Cagliano et al. 2012; Christopher & Holweg 2011; Kazmer 2014; Steinle 2008). Butner (2010) stated that, as global supply chains are becoming more complex, they are more costly and vulnerable, and executives of manufacturers are encountering increasing difficulty in responding and finding perfect solutions for those challenges.

Therefore, Australian manufacturers who produce innovative products and have the intention to remain only in the Australian market need to consider whether it is worth addressing global sourcing or offshore manufacturing. Although product prices are much lower in Asian countries, supply chain complexity, difficulties in supply and logistics, volatility in the business environment, and several other issues can reduce the benefits of international sourcing (Butner 2010). Several authors have highlighted the disadvantages of international sourcing and offshore manufacturing, as it creates greater challenges than onshore manufacturing (Arika 2013; Cagliano et al. 2012; Kazmer 2014). These challenges include complexity, managing different time zones, cultural differences, possible communication failures, political instability, lack of infrastructure, exchange rate fluctuation and several other variables (such as hidden costs). It is stated by several

researchers that the total value of an offshore operation can increase normal operations by as much as 4 to 8%; however, in many cases, the figure jumps to 50% because of hidden and unexpected costs (Christopher et al. 2011; Hannon 2009; Holweg et al. 2011; Pagani 2004). In addition, there are difficulties with corporate governance, risk management, language and cultural problems, quality issues in terms of proceeding with testing and evaluation, and lost knowledge and skills (Adonis 2012; Gray et al. 2011).

Organisations must cautiously consider all the risks and costs of offshore manufacturing before deciding to send jobs offshore (GT 2011; Pagani 2004). Although, in many cases, firms achieve benefits from global sourcing, they can also lose flexibility and commercial benefit (Butner 2010; Candace et al. 2011). In cases when a quick response is required in a technologically complicated operation, it is not advisable to risk key skills for short-term savings. If Australians are serious about developing Australia as an intelligent nation, Australian business owners should think more deeply about the long-term consequences of their decisions and consider the interests of the country more seriously than they do currently (Lindhe 2012).

This study uses the following research question to explore this topic in the context of Australian manufacturers:

How can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user?

This research question is supplemented by the following sub-questions:

- What is the trend among Australian manufacturers regarding local sourcing and local manufacturing strategies?
- What is the view of Australian manufacturers in regard to the effect of lean, agile and flexible supply chain strategies on their operations?

## **1.4 Research Significance**

This research contributes to academia, practitioner communities and government entities. From an academic standpoint, this research represents one of the initial empirical studies to

focus on flexible supply chain management alongside onshore manufacturing. Specifically, this research:

1. develops a conceptual model that investigates how companies can manipulate their sources and capabilities in a rapidly changing environment, as well as the relevant antecedents and outcomes
2. provides a valid and reliable understanding of the advantages of onshore manufacturing and business contextual dynamism for consumer requirements
3. contributes to the literature by applying this conceptual model to the Australian manufacturing industry.

In short, the outcomes of this research not only provide an exploratory foundation for future research on the subject of flexible supply chains, but also reveal the procedure of generalising a conceptual model in a particular situation context.

Within Australia, the government established a taskforce (DIISRTE 2012) to explore Australian manufacturing (issued in July 2012). The taskforce's report stressed the importance of keeping Australian manufacturers in the country. Although the report proposed several suggestions to achieve this goal, few seem to have been realised. Similarly, the outcomes of the taskforce focused largely on government support and intervention, yet did not propose a business strategy as a self-sufficient organisational fulfilment'. This research will provide more insight into the areas that the government highlighted as part of this taskforce in identifying the advantages of onshore manufacturing.

For practitioners, this research provides insight into how companies can gain competitive advantage in a volatile business environment. In particular, this research:

1. explores how companies develop their operation and supply chain strategies
2. explains which factors affect the mechanisms that companies use to develop their supply chain management
3. discusses which outcomes can be expected from companies who apply onshore operations with flexible supply chain management.

Based on the outcomes of this research, industrial practitioners—especially the managers of

Australian manufacturing companies of innovative products—can adjust their supply chain arrangements and consider a more focused and in-depth view of agile supply chains with a local sourcing strategy and its co-related dependencies. The research also expands the current knowledge of the factors that affect supply chain performance in the manufacturing sector, thereby providing a further avenue to solve its continuing problems in performance.

## **1.5 Research Methodology**

Although some well-known theories in the supply chain management domain seemed to be appropriate to use in this research, such as Resource Based View, Transactional Cost Analysis, and Porter Five Market Forces, in the process of reviewing the literature and considering other possible theories, two recent significant and relevant theories emerged, as Dynamic Capabilities (DC) and Total Cost of Ownership (TCO) analysis were identified in the area of turbulent and unstable business environments. Both theories had the capacity to be applied in this study, where the research question was sensitive in terms of academic and business-related aspects. Moreover, in recent times, DC and TCO theories have gained much more significance for exploring competitiveness in a volatile business environment compared to RBV and TCA. However, dynamic capabilities theory and total cost of ownership analysis alone have limited explanatory power; thus combining these theories has the potential to develop a more complete understanding of the research problem. This study focuses on frequent innovators (innovative manufacturers); hence, a question emerged regarding what is the optimal solution for innovative manufacturers to achieve long-term competitive advantage in a volatile business environment. Involving these two theories, a theoretical framework was developed with all the related areas examined in this study, such as business environment, type of product, theories involved, type of managerial strategies, and geographical distance between manufacturing site and end-user. According to the theoretical framework, these factors together determine sustainable competitive advantage in a successful supply chain.

In terms of the theoretical framework, the research situation aligns with qualitative research. The research design had several stages that helped demonstrate rigour. Within qualitative research approach, the data used to understand the decision-making process of

evaluating strategies of value delivery were primarily sourced from interview data (Creswell 2017; Salkind 2010). It is an exploratory, interpretive research that logically links abstract ideas to precise measurements of the social world (Neuman 2006; Wahyuni 2012). To investigate a contemporary phenomenon in its real-life context, the case study approach was applied (Yin 2003, Richards and Morse 2013). Furthermore, the research approach was a sequential exploratory strategy, which included preliminary interviews and a secondary online survey for data collection. According to Creswell (2009), it is suggested to conduct interviews when the investigator has enough knowledge to develop a question about the certain case, but not enough to anticipate the answer; semi-structured interviews are the best method to choose. In specific cases it is recommended to conduct online survey for validation of interviews results (Canvana and Delahaye 2011; Wetcher-Hendricks 2011). The analysis of the interviews was done by NVivo, with the assistance of thematic coding (Gibbs 2007; Coffey and Atkinson 1996; Boyatzis 1998). As qualitative analysis was the preliminary research method in this study, survey questionnaires were analysed with a basic statistical model (Creswell 2009).

## **1.6 Research Structure**

This thesis is organised as follows. Chapter 2 presents the literature review, which explores the literature on topics including onshoring, offshoring, and flexible and agile supply chains. The literature review examines research to help the reader gain a better understanding of the context of this research and the research that has been conducted to date. It discusses the origin and structure of supply chain management, the characteristics of Australian manufacturers, and different management philosophies that have been successful in the past. It explores the role of government task forces; organisational agility versus flexibility; the difference between innovative and functional products; lean, agile and 'leagile' supply chains; the relationship between flexibility and responsiveness; and the characteristics of a responsive supply chain.

Chapter 3 outlines the theoretical framework that forms the lens through which this research is viewed. The chapter discusses the relevance of the dynamic capabilities theory and the total cost of ownership analysis, and how they relate to the current research.

Chapter 4 outlines the possible selection of research strategies and the chosen approach, provides justification for the characteristic of the research situation for the underlying research philosophy, such as the main aspects of the research philosophies and paradigms. This chapter also describes the research design, along with the adoption of qualitative research approaches and the view of the case study method. Further, Chapter 4 provides detailed information about data collection, gives a brief overview of the data analysis approach, and concludes by outlining the research methodology section of the study.

Chapter 5 presents the qualitative data analysis. It discusses the results of the coding scheme in a format that can be easily interpreted and analysed. Chapter 6 presents the quantitative data analysis. Chapter 7 discusses the implications and results derived from the findings, as well as the highlights obtained from the data. Chapter 8 presents the conclusions that can be drawn from the research study. It also presents recommendations about how to apply the identified outcomes, as well as suggesting future research that could be conducted to advance understandings of the research findings. In addition, this chapter details the challenges identified in the research that need to be addressed. This chapter also discusses the research contributions to academia, practitioners and the government.

## **Chapter 2: Literature Review**

### **2.1 Introduction**

As introduced in the preceding chapter, noticeable number of manufacturers in the U.S. and Europe are reconsidering their corporate strategy and returning their operations from overseas (Ellram et al. 2013; Kazmer 2014; Kinkel 2011, Kotabe & Murray 2004). Global sourcing creates greater complexity, which increases logistics costs. It also increases the number of business failures and contributes to the potential loss of organisational reputation (Cagliano et al. 2012; Holstein 2010; Holweg et al. 2011; Williams 2009). International sourcing and offshore manufacturing can result in greater investments because of long-distance transportation, and can generate other hidden costs, alongside the difficulties of managing outsourced manufacturing remotely. According to Christopher et al. (2011), organisations that have a flexible supply chain, including a local sourcing strategy, combined with lean and agile principles in their operations, are able to respond more rapidly to the ever-fluctuating customer demand and increasingly turbulent market, compared with firms who use global sourcing strategies.

The literature indicates that a high number of manufacturing jobs in Australia are now being outsourced (DEEWR 2012; SBA 2012; UA 2012). There was a continuous rise in the manufacturing industry in Australia until the late 1950s; however, since then, there has been a progressive decline. This decline is largely due the rise of the dollar over a short period (UA 2012). Further, according to the Australian Government Department of Employment (AGDE 2014), although the manufacturing sector is the fourth-largest employing industry in Australia, employment declined by 7.2% over the 10 years to February 2014. Moreover, according to the Australian Bureau of Statistics (ABS 2017), over the 10-year period from 2006 to 2016, manufacturing industry employment decreased by 167,000 people. Further significant decreases are predicted in the numbers of employees in the manufacturing sector, which indicates that governmental action should be implemented to weaken the effect of decline. While the manufacturing, retail and wholesale



industries were the highest income generators in 2006, this changed in 2015 to 2016, when construction sales and services income overtook manufacturing income (ABS 2017).

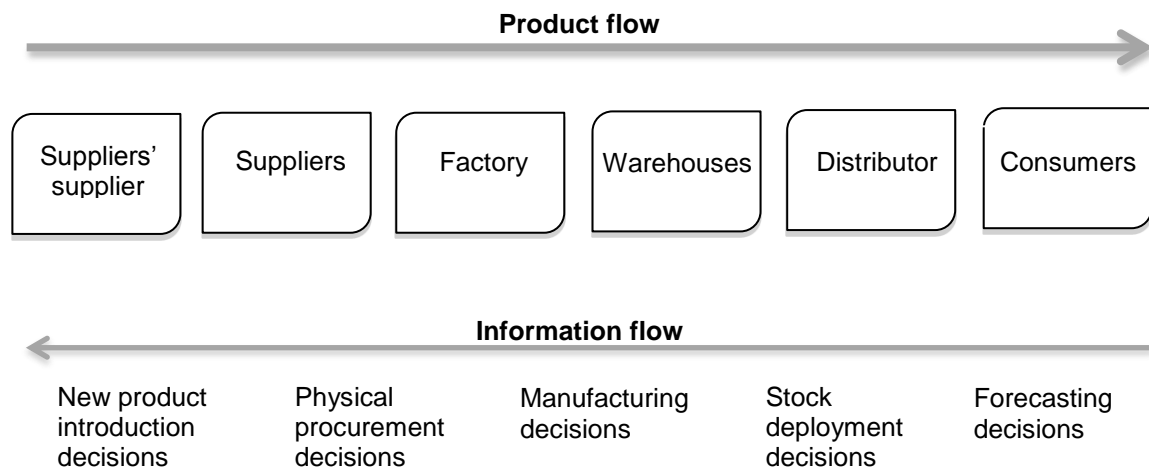
The following sections present a review of the literature on the trends of supply chain management strategies and activities; the advantages and disadvantages of global sourcing and offshore manufacturing; studies related to onshore flexible and agile supply chains; value-adding processes in the supply chain context; global supply chain trends and problems; an overview of Australian manufacturing; offshore and onshore manufacturing trends; governmental reports and taskforces; different successful management philosophies in the area of operation and supply chain management; the difference between functional and innovative products; organisational agility versus flexibility; agility in the supply chain; lean, agile and leagile supply chains; achieving competitiveness through different management philosophies while remaining onshore; the relationship between flexibility and responsiveness; and responsive supply chains. These aspects of supply chain management are presented to provide a proper foundation for this study.

The literature review contributes to the research questions by presenting the results from an international academic search to examine the different views on the topic and provide answers to the research question. In addition, based on summarising the recent trends in the area of operation and supply chain management, according to the literature, agility is one of the main drivers to gain a long-term competitive advantage in the current volatile business environment—especially for organisations in the manufacturing sector.

## **2.2 Supply Chain Management**

The difference in management between now and 50 years ago is that, today, supply chain management works in an environment of increased computer technology and globalisation (Prajogo 2012). These main trends are combined with e-commerce technologies and different business models that allow customers to acquire products or services worldwide (Schniederjans et al., 2010).

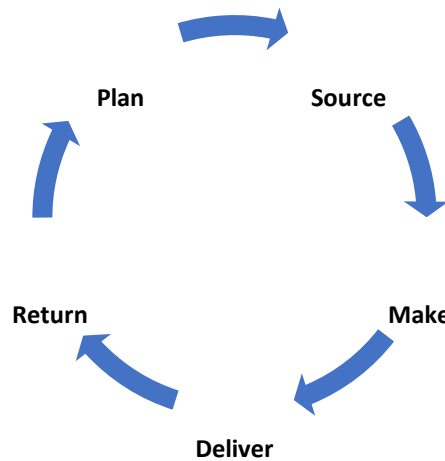
Supply chain management refers to the coordination of business partners to achieve common goals (Schniederjans et al. 2010), for instance, firms form partnerships for the purpose of minimising costs, maximising profits, adding value, maintaining a quick response to the final customer, and achieving a competitive advantage in the business environment (Vonderembse 2006). Several definitions can be found for supply chain management; however, Handfield and Nichols (1999) presented a commonly accepted definition, as it is cited heavily in Google Scholar. They stated: ‘The supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stage, through to the end user, as well as the associated information flows’ (Handfield and Nichols 1999, p. 2). This is explained in Figure 2.1, which traces the product flow from the materials stage (extraction) through to the end-user, as well as the associated information flows (Myerson 2012).



**Figure 0.1: Product and Information Flow in a Supply Chain (Adapted from Myerson 2012)**

In accordance with Schniederjans et al. (2010), supply chains can have impressive results for business operations, as the tools and theories of the business model are integrated into the firm and the upstream and downstream partners. This helps integrate information and product flow all along the chain, and assists in optimising production and distribution flows from raw materials to finished goods, thereby ensuring products are delivered on time.

These days, companies largely concentrate on their core competencies, and outsource their value chain operations to business partners (Christopher et al. 2011; Lau and Lee 2000;). As such, it is important for organisations to create an environment in which business partners and suppliers interchange information efficiently. For a company to achieve sustainable competitive advantage, it is important to monitor the activities beyond its boundary. For this reason, companies need to apply efficient information exchanges that enable the entire supply chain to gain efficient raw material and product flows (Lau and Lee 2000). Efficient communication is the driver of an efficient supply chain. In the literature, the supply chain is divided into five management processes, as presented in the supply chain operations reference (SCOR) model in Figure 2.2.



**Figure 0.2: SCOR Model (Adopted from Huan, Sheoran & Wang 2004)**

The SCOR model includes the five basic elements of manufacturing activity. As can be seen in Figure 2.2, the activities of the process are in a specific order and the process always repeats in a cyclical fashion, as follows:

- plan—balance and arrange supply and demand
- source—procure materials and goods to meet demand, including identifying and selecting suppliers, performance measurement of the source, and transportation and warehouse management of the goods
- make—convert the goods from raw materials to finished goods

- deliver—logistics management to move products along the supply chain, including between suppliers, manufacturers, warehouses and distributors, until the consumer is reached
- return—reverse logistics, including returning products from consumers for repairs, sustenance, overhaul or recycling (Li et al., 2010, Bolstorff and Rosenbaum, 2007).

Alongside the main elements of a supply chain, the process includes several functional activities that need to be finalised. These activities include information management (generate, forecast and share information with channel partners); procurement, scheduling and control of inventory flow; infrastructure and transportation management; facility management of distribution points; and customer service (order and fulfilment management) (Myerson 2012). To develop a deeper understanding of this idea, it is important to examine Porter's (1985) value chain system. As Porter (1985 p. 36) discussed, a value system is an integrated arrangement of the different activities of a company, from the suppliers to the ultimate consumers.

According to Porter (1985 p. 36), the value chain comprises 'a firm's activities that are performed to design, produce, market, deliver and support its product'. Porter (1985) discussed that a value chain is a set of activities that an organisation performs to create value for its customers. Porter (1985 p. 34) also suggested that each firm's value chain 'is embedded in a larger stream of activities', which he called the 'value. The value system incorporates the focal company's value chain, as well as its upstream and downstream partner activities, such as raw material suppliers', distributors' and ultimate buyers' value chain. The next section summarises the advantages and disadvantages of global sourcing and offshore manufacturing.

## **2.3 Global Sourcing and Offshore Manufacturing Trends**

According to Murray (2001), while global sourcing originally referred to procuring raw material from overseas suppliers, over the years, it has become much more important as an international pursuit. Global sourcing has great significance to maximise an organisation's competitive advantage in its business environment. The fundamental goal of global sourcing is for the firm to take advantage of both local and global marketplaces. According

to Edgell et al. (2008) specifying the sourcing locations dependent on the investment in activities and technologies, and the purchasing and selling points as well (Edgell et al. 2008). Table 2.1 describes the main benefits of international sourcing as the following: the possibility of a presence in foreign markets, lower wages, possible quality improvements, the ability to acquire resources not available in the home country, increased knowledge of worldwide technology, global presence of the firm, low-cost raw materials, low-cost components or final products, and reduced commercial barriers (Holweg et al. 2011; Nassimbeni 2006;).

**Table 0.1: Advantages of Global Sourcing and Offshore Manufacturing**

<b>Different authors' view of the advantage of global sourcing</b>	
Cost reduction	Holweg et al. 2011, Nassimbeni 2006, Murray 2001, Platt and Song 2010
Take advantage of both local and global marketplaces	Edgell et al. 2008
Market expansion	Christopher et al 2011, Nassimbeni 2006
Lower transportation costs, faster deliveries, lower duties and tax costs, and low product cost in regard to low labour and land cost	Murray 2001
Increasing knowledge of international regulations	Edgell et al. 2008; Platt and Song 2010; Oshri et al. 2009
Expansion of the brand name in the market.	Murray (2001), Oshri et al. 2009
Sourcing goods, materials and components at lower costs	Nassimbeni 2006
Attaining assets and resources unobtainable in the home country	
Global mindset of the company	
Possibility of attaining advanced technologies	
Better taxation	
Accessibility of selling products on sourcing markets	
Reduction of commercial barriers	
Increased exposure to worldwide technology	Holweg, Reichhart & Hong(2011)
Competition with local supply base	
Satisfying offset requirements	
More available sources	
Presence of offshore sourcing competition	
Advanced political and administrative environment	Christopher et al. (2011)
Reassuring the availability of limited resources	
Skilled workforce	
Varied selling and purchasing points	
Lower production price	
Lower investment cost	

The above advantages are relevant in some cases; however, it is important to consider whether they are all viable for Australian manufacturers. For example, delivery is generally not reliable when shipping products between continents (Williams, 2009, Ritter and

Sternfels, 2004). In addition, higher speed and flexibility are more relevant advantages when discussing onshore manufacturing, as well as an advanced political and administrative environment in Australia. Moreover, quality improvements are not necessarily viable advantages for the offshore production environment (Beer 2004; Gray et al. 2011; William 2009).

Global purchasing has become an increasing trend worldwide because it is associated with economic development (Christopher et al. 2011; Edgell et al. 2008; Oshri et al. 2009). When seeking competitive advantage, firms take every potential opportunity to increase their profits and satisfy their customers' requirements. Making the decision to source globally derives from the intention to improve the firm in several ways, including increased market presence, technology, sources and workforce possibility (Christopher et al. 2006; Kotabe and Murray 2004; Liu et al. 2010; Sahay and Ranjan 2008). However, this decision also entails risk in terms of the firm's smooth and stable operation (Christopher et al. 2011; Duclos et al. 2003; Moser 2011; Weber et al. 2010).

Globalisation no longer supports the country-by-country approach in terms of distribution, as international organisations can now access a number of markets at the same time (Edgell et al. 2008; Kazmer 2014). Additionally, global competition leads to shortening the lifecycle of most products, as multinational companies satisfy their customers more frequently (Weber et al. 2010). However, competition in the market provides advantages for customers, such as lowering price and increasing quality. It also creates a sustainable competitive market between rivals (Kotabe and Murray 2004). In this regard, to achieve competitive advantage against multinational organisations, several Australian manufacturers have decided to adopt global sourcing or offshore manufacturing to benefit from Australia's geographical proximity to low-cost Asian countries, which can, in many cases, make Australian offshore manufacturing even more viable than for manufacturers from other parts of the globe (AFR 2013; Beer 2004).

However, contrary to the global supply chain trends, recent studies have highlighted the advantages of local manufacturing, with the combination of different supply chain strategies. Thus, the next section discusses the advantages and disadvantages of offshore manufacturing and global sourcing.

## **2.4 Advantages and Disadvantages of Offshore Manufacturing and Global Sourcing**

During the last two decades, outsourcing or offshore manufacturing has become the favoured management orientation (Butner 2010; Kotabe and Murray 2004; Mangan and Lalwani 2016; Masson et al. 2007; Oshri et al. 2009; Spina et al. 2013). Many companies believe that sourcing goods from low-labour-category countries—such as China, South Korea, Indonesia, Malaysia and India—is still viable (Christopher et al. 2011; Manyika et al. 2012; Oshri et al. 2009). They overestimate the savings and do not realise the negative effects, such as dealing with exchange rates, obsolescence, inventories and many other dynamic and hidden costs. When competitive advantage derives from speed and a track record of reliability, offshore manufacturing is often not the appropriate strategy (Cagliano et al. 2012; Kinkel 2011). Speed becomes a competitive weapon, and an inadequate and slow supply chain can create a trap that can hinder the entire operation (Cagliano et al. 2012; Platt and Song 2010; Tunisini et al. 2011).

While speed and reliability have become the priority in many operations, numerous supply chains have failed because of unreliable delivery schedules; rising raw material, product and labour prices; as well as larger investment in the inventory because of large minimum orders and longer paths. Slow and delayed transportation can also result in loss of company goodwill (Pagani 2004). Manufacturers and retailers are at the mercy of Asian suppliers. With local supply chains weakening because of the long-distance origination, little can be done to overcome the costs of increasing Asian prices. Although locally manufactured goods cost slightly more than imports, they are closer to home, require shorter transportation, are higher quality and arrive on time (Picker 2016).

For the purpose of discussing effective manufacturing and supply chain operations and comparing them with global sourcing operations, the next section highlights the recent trend of responsive local manufacturing with the combination of flexible supply chain management.

### **2.4.1 Direct, Dynamic and Hidden Costs of Offshore Operations**

Initially, global sourcing was used for ‘in-house’ operations, such as supplying production with materials or goods from overseas (Holweg et al. 2011; Oshri et al. 2009). Recently, offshore manufacturing has become the favoured management orientation (Butner 2010). This direction seems to be effective and offers organisations the possibility to achieve competitive advantage. However, in the last 10 years, global economic uncertainty and volatility have weakened the benefits of global sourcing as greater risks appear. Manufacturers and retailers are at the mercy of international suppliers and local supply chains become weak because of the distance (Pagani 2004). Although locally manufactured goods cost slightly more than their imported counterparts, they are closer in terms of transportation, can potentially provide better quality and arrive on time (Gray et al. 2011; Stanczyk et al. 2017). Table 2.7 describes the costs of offshore operation/global sourcing, categorised as direct, dynamic and hidden types of expenses (Christopher et al. 2011; Hannon 2009; Holweg et al. 2011;). Direct costs can be calculated because their variables are predictable; however, dynamic and hidden costs are mostly unpredictable. Thus, organisations are unable to express these costs in the business plan. To consider all the risks and costs of offshore manufacturing, organisations should make cautious decisions before choosing to send jobs offshore.



**Table 0.2: Different Costs of Global Sourcing and Offshore Manufacturing (Adopted from Christopher et al. 2011; Hannon 2009; Holweg et al. 2011)**

Direct costs	Dynamic costs	Hidden costs
High transportation costs compared with local sourcing	Inventory destruction because of long transportation, e.g., in case of quality problems	Increased wages in host country because of rising living standards and market competition
Quality problems	Increased transportation time and safety stock because of demand volatility and variety	Communication problems because of lack of personal discussion because of the distance
Longer lead time	Much more investment in inventory because of long-term transportation	Lower responsiveness and lost or damaged products
Much higher transportation costs	High investment because of high quota restriction	Loss of know-how
Customs and duty costs	High level of carbon emissions and environmental risk	Fluctuation in interest rates
Transaction and insurance costs	Cost of lost sales and out-of-stock because of delayed transportation	Cultural and time differences
Higher inventory costs because of the long transportation time	Cost of urgent and expedited shipments (e.g., air freights) to provide continuous supply	Lack of corporate social responsibility
Cost of quality control, investigation of safety and environmental conformity	Regular failure in transportation because of long distances and poor infrastructure	Political and economic instability and possible terror attacks
Extra cost to manage international business, including extra cost of bilingual professionals, agencies, local personnel and travel	Increased rules and regulations	Rise in transportation costs because of higher oil price
	Uncertainty because of supply failures and unsatisfied consumer demand	Uncertainty over the long-term effect on supply and demand
		Lower profit because of hidden costs

The above expenses are not the only costs to consider when determining whether to manufacture offshore or onshore. Specifically, the literature addressing the landed costs and economies of scope needs to be explored (Ellram 1995; Teece 1980; Young et al. 2009). The landed cost refers to the total cost of a product once it has arrived at the buyer's door (Chan 2003). The elements that need to be considered to determine the landed cost include the original cost of the item, all brokerage and logistics fees, the complete shipping costs, customs duties, tariffs, taxes, insurance, currency conversion, crating costs and handling fees (Pal 1964). It should be noted that not all of these components are present in every shipment; however, these need to be considered part of the landed cost. Meanwhile, the economies of scope refers to the factors that cause the average cost of producing something to fall as the volume of its output increases (Panzar & Willing 1981; Teece 1980).

Without considering and calculating the different dynamic, hidden and invisible costs of an offshore operation, organisations are unable to explore the true costs of the offshore operation. Calculating these costs also provides an appropriate analytical tool for comparison of the onshore and offshore costs of an operation. Hidden, dynamic, invisible and lifecycle costs are related to TCO calculation, which is discussed in the following chapter.

## **2.5 Onshore Manufacturing with Flexible and Agile Supply Chains**

Expanded supply chains can provide companies with operational effectiveness, which can lead those organisations to achieve high performance and competitiveness (Candace et al. 2011; Christopher et al. 2011; Holweg et al. 2011; Jia et al. 2017; Khan et al. 2008; Liu et al. 2010) . Nevertheless, emerging risk can affect the benefits of global businesses, weaken a company's reputation and damage competitiveness (Liu et al. 2010). As reported by Christopher et al. (2011), Stanczyk et al. (2017) and Vos et al. (2016), poor synchronisation in the supply chain is frequently caused by outsourcing and offshoring decisions. Further, product complexity; variance in components, suppliers, manufacturers and transportation paths; communication failures; misunderstanding of product requirements and misleading the brand's strategy are the key risks of global sourcing (Abdullah and Verner 2012; Holweg et al. 2011; Stanczyk et al. 2017; Vos et al. 2016;). As the above authors stated, global sourcing causes the supply chain to become longer and less integrated, thereby potentially causing firms greater risk and cost.

To approach global sourcing debate another way, in agreement with Butner (2010), building a supply chain that focuses only on effective operation and demand-driven achievements is no longer feasible. Today, businesses need to be smart and flexible in terms of quick reactions to rapidly changing market conditions. For this reason, many organisations have switched their management philosophy to an agile supply chain that is adaptable to a fluctuating business environment (Butner 2010; Sharifi et al. 2006; Tseng and Lin 2011; Vazquez-Bustelo et al. 2007; Zhang and Sharifi 2007). Opposing the offshore outsourcing and global sourcing trend, recent studies have indicated the benefits of local sourcing and close manufacturing. A number of publications and articles have

addressed the importance of onshore manufacturing combined with different types of supply chain techniques. Table 2.2 summarises the various studies and articles related to onshore supply chain flexibility.

**Table 0.3: Studies and Articles on Onshore Supply Chain Agility**

Author/year	Title	Findings
Christopher et al. (2011)	‘Approaches to Managing Global Sourcing Risk’	Companies found considerable difficulty in obtaining both delivery on time and the desired quality from their global supplier
Christopher & Holweg (2011)	‘Supply Chain 2.0: Managing Supply Chains in the Era of Turbulence’	Manufacturers should increase their ‘local for local’ strategy, manufacturing in countries that are nearer to their markets
Cagliano et al. (2012)	‘A Decision-making Approach for Investigating the Potential Effects of Near Sourcing on Supply Chain’	Near-sourcing is essential when supply chain strategy focuses on core competencies and on achieving improvements in profitability, efficiency and flexibility
Holweg et al. (2011)	‘On Risk and Cost in Global Sourcing’	Many global sourcing venture are actually not economically viable because of unexpected, hidden and dynamic costs
Steinle and Schiele (2008)	‘Limits to Global Sourcing? Strategic Consequences of Dependency on International Suppliers: Cluster Theory, Resource-based View and Case Studies’	Two contrasting case studies illustrate that, contrary to common expectations, a high global sourcing quota does not necessarily improve a firm’s competitiveness
William (2009)	‘International Sourcing: Offshore or Near-shore’	For some companies and under certain conditions, the best way to streamline supply chains will be to bring sourcing and manufacturing closer to home
Moser and Lang (2011)	‘Reshoring Manufacturing can Increase Your Competitiveness’	The advantages of the rising costs of low-labour-cost countries, customer recognition of the total cost of ownership, and increased customer demand for shorter supply chains and faster response will help businesses make decisions about reshoring
Duclos et al. (2003)	‘A Conceptual Model of Supply Chain Flexibility’	Global sourcing is inflexible because of its complexity; thus, it cannot react rapidly to consumer trends for both products and geographic areas
Weber et al. (2010)	‘Low Cost Country Sourcing and its Effects on the Total Cost of Ownership Structure for a Medical Devices Manufacturer’	A considerable part of costs in low-cost-country sourcing accrues at the beginning of a purchasing project because of problems stemming from unsatisfactory quality, language barriers and intercultural communication
Pagani (2004)	‘Manufacturing Execs Should Focus on	Manufacturing executives should focus on

	Becoming Lean Before Going Offshore'	becoming lean before going offshore
Picker (2016)	Manufacturing in America: The Real Benefits and the Drawbacks or Reshoring	If the US offshores most of its plants to Asia, there will be no viable supply chains remaining in the US, and nothing can be done if Asian suppliers decide to raise prices
Emerald (2005)	'Distorted Outsourcing Decisions: Product Redesign, Not Manufacturing Outsourcing'	In many cases, product redesign would be a better option than offshore outsourcing

Appendix I presents a summary of further publications exploring local manufacturing, local sourcing, manufacturing closer to the end-user, onshore manufacturing, reshoring, backshoring, the risks of global sourcing and offshore manufacturing, and rightshoring.

Although information about customer demand and product flow is plentiful and business connections are growing rapidly, demand information visibility seems to be one of the most challenging aspects of a manager's tasks (Butner 2010; Kembro and Selviaridis 2015; Song et al. 2016). Paradoxically, as more information becomes accessible, fewer data about the customer demand are adequately collected and analysed for the people who need them (Butner, 2010). Surprisingly, most executives do not believe that sharing information with supply chain partners is an important managerial task, although successful companies and supply chains do share key information, make decisions collaboratively and employ risk-management strategies (Butner 2010; Jonsson and Myrelid 2016; Kembro and Selviaridis 2015). Moreover, global sourcing increases complexity, which works against agility. Even if high-level agility has been implemented in the supply chain, flexibility is impossible because of the complex global sourcing strategy (Abdullah and Verner 2012; Agarwal et al. 2007; Aitken and Bozarth 2016; Choi and LKrause 2006; Prater et al. 2001).

Among several views for achieving competitive advantage, according to Prater et al. (2001), firms should build a membership of a strong regional sectoral system, with local sourcing possibilities. Collaboration and common goals can be beneficial to the cost of goods and materials, as well as the service aspects of the supply chain. Several other researchers emphasised their views on how to increase firms' chances in a supply chain to achieve competitive advantage, such as the implementation of lean strategies (Agus and Hajinoor 2012; Alves et al. 2012; Kumar et al. 2012; Myerson 2012; Pagani 2004; Phelps et al. 2004; Prajogo et al 2016; Uhrin et al 2017), agile strategies (Abdoli Bidhandi &

Valmohammadi 2017; Ismail & Sharifi 2006; Liu et al. 2010; Malakouti et al. 2017; Mason-Jones et al. 2000) or both lean and agile strategies (Browaeys and Fisser 2012; Castro et al. 2012; El Mokadem 2017; Goldsby et al 2006; Mistry 2005; Naim & Gosling 2011; Naylor et al. 1999; Shahin et al. 2016;) Many of these authors suggested that organisations' executives should consider implementing lean and/or agile management before going offshore.

As a part of the sourcing debate, Cagliano et al. (2012) expressed the view that near-sourcing is the only possibility when profitability, efficiency and flexibility are equally important in supply chain operations. Lean and just-in-time (JIT) chains are not compatible with offshore manufacturing. Through a case study, Cagliano et al. (2012) highlighted the fact that international sourcing or offshore manufacturing needs to apply two-step sourcing, which necessitates in-house warehouse requirements because it prevents direct delivery of the goods to store locations. Two-step sourcing or third-party logistics (3PL) in offshore manufacturing weaken the advantages of cost cutting offered by Asian suppliers.

In opposition to the trend of offshore manufacturing and expressing the advantages of close manufacturing, the following sample shows that not all companies are adopting the offshore strategy:

In an age when companies are sending thousands of high-wage manufacturing jobs offshore, Toyota Motor still makes Corollas in Silicon Valley—one of the most expensive places on Earth to produce goods! (Ritter and Sternfels 2004 para. 1).

The answer is explained by Toyota's business principle that sending goods within few hundred kilometres in 24-48 hours is better than shipping them between continents, across logistical and political boundaries in one month. But to act on this principle, a company must be efficient enough to produce its goods close to the places where they are in demand, even when labour costs are high.

This section of the study has explored the advantages and disadvantages of global sourcing, offshore manufacturing and local manufacturing, and provided a brief overview of the ways that certain manufacturers have attained benefits from producing in Asia, while others prefer local sourcing and production close to the end-user. This discussion raised emerging

questions about which types of manufacturers can benefit from going offshore, and which types of manufacturer choose to stay onshore.

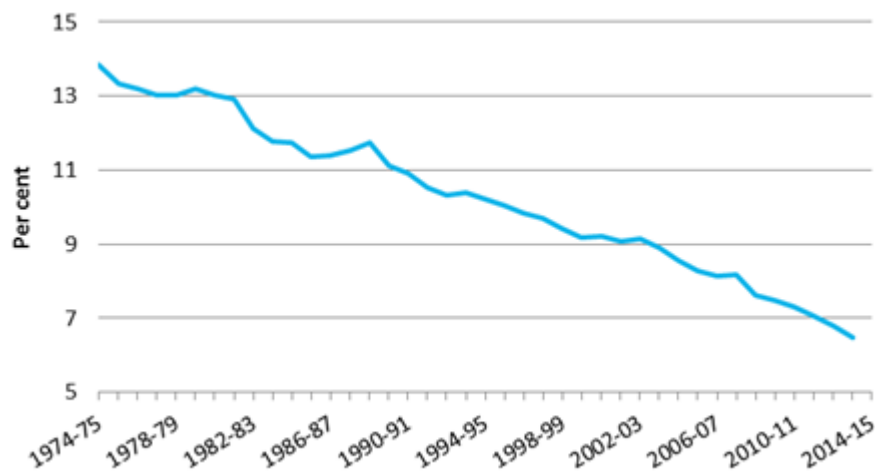
## **2.6 Manufacturing and Government Taskforce Overview**

### **2.6.1 Australian Manufacturing Overview**

Manufacturing has an important role in a country's economy and development. In many cases, the manufacturing sector contributes primarily to the modernisation and expansion of a country (ABF 2011). There are few examples of countries with high living standards in which the manufacturing sector did not contribute significantly to the economic output (ABF 2011). There is a crucial structural link between manufacturing and innovation, which explains why manufacturing is the most innovation-intensive part of the economy, and why innovation is inevitably manufacturing oriented (TAI 2016).

As illustrated in Figure 2.3, in agreement with the Australian Department of Industry, Innovation and Science (DIIS 2015), the contribution of the manufacturing industry to the overall size of the Australian economy has been falling over many years:

In 2013–14 its share of gross domestic product (GDP) was 6.5 per cent, which is less than half what it was four decades earlier. Moreover, the decline in the manufacturing industry shows no sign of abating, with the industry's share of GDP falling at a more or less constant rate over the entire period (DIIS, 2015).



**Figure 0.3: Manufacturing Industry's Share of Gross Domestic Product (DIIS, 2015)**

As a result of the rise in the Australian dollar, rigid competition in the business environment, increasing energy and other expenses, and decreasing customer demand, Australian manufacturers find themselves in a weak economic position (ABS 2017). Further, the manufacturing environment of the country has become fragile because of the 'patchwork nature' of the Australian economy. A patchwork economy refers to different patterns of economic development across industries and regions (DIISRTE 2012). One of the reasons for the decline in the manufacturing sector is the regulations and increasing operational costs, and thus it makes difficult to suggest how to add value through applied knowledge or which management strategy to choose.

### **2.6.2 Offshore and Onshore Manufacturing Trends among Australian Manufacturers**

According to several studies, more Australian manufacturers are moving their operations offshore mainly because of price competitiveness (CBS 2012; DIISRTE 2012; MM 2009; Thorp 2012). In 2009, Bonds, and, in 2012, companies such as Suncorp, Heinz, Telstra, Westpac, Woolworths, Aerogard and Dettol all declared they were sending jobs to places such as India, Malaysia, New Zealand and the Philippines (Adonis 2012; Lindhe 2012). The key reason for manufacturers moving offshore is related to labour cost and the rigidity of the labour market (CBS 2012; Green 2017). The Australian Prime Minister's Taskforce

on Manufacturing (DIISRTE 2012) report by the Australian Government announced that, since the beginning of the global financial crisis, more than 100,000 Australian manufacturer workers had lost their jobs. Moreover, according to a prediction by the Australian Department of Industry, Innovation, Science, Research and Tertiary Education, another 87,000 will lose their jobs in the near future (DIISRTE 2012).

In contrast, there are many successful onshore stories in the Australian manufacturing sector, where product price does not affect the manufacturer or the customer because the quality or service of the product can support a high price (DIISRTE 2012; Lindhe 2012). Even if these products can be replaced with goods from Asia, consumers are unwilling to buy those goods because they wish to purchase good-quality or unique products at any price level (ABS 2017). Some manufacturers in Australia are aware that, even though quality processes are implemented in offshore plants, they will not receive the same high-quality products back (DIISRTE 2012; TAI 2016). Many Australian companies would never cheapen their brands by manufacturing in China—examples include furniture manufacturer, Jimmy Possum, and women's clothing retailer, Cue (Lindhe 2012). If price is the only differentiator for gaining sales, then the outlook of the Australian manufacturing sector is frightful (CBS 2012).

In terms of the price of a product, as a consumer, most people search for the lowest price (Feil 2012; Platt & Song 2010). Meanwhile, a stakeholder or an executive focuses on the optimal possible profit that can be earned. Offshoring can fulfil both of these expectations (Feil 2012). However, as a member of a nation, every individual should be aware that, while offshore manufacturing has many advantages, these only exist in the short term (Stanczyk et al. 2017; Ritter & Sternfels 2004). In the long term, offshore manufacturing creates problems for the society and economy. As unemployment increases, government income decreases, and this situation generates activity in the economy (Moser and Lang 2011). In the US, the emerging issue to bring back the multiple thousands of manufacturers has been launched over the last few years, and politicians are working hard to convince stakeholders and executives to rethink the situation and consider manufacturing onshore (Feil 2012; MH&L 2017; Moser & Lang 2011).



In summary, while several Australian manufacturers have moved production overseas, there are still numerous manufacturers who can sustain their production within Australian borders, and the Australian manufacturing sector still contributes significantly to economic output, comprising 6.5% of the gross domestic product (GDP) (DIIS 2017). The aim of this research is to determine whether there is any particular type of manufacturer that can stay local and whether agile supply chains add value to those manufacturers that decide to stay onshore. This research explores the viability of a theoretical framework for onshore strategic agility when making decisions about onshore or offshore manufacturing operations of Australian manufacturers. Furthermore, this study explores how agile supply chain management assists in creating value-added innovative products closer to the end-users.

### **2.6.3 Governmental Reports and Taskforces**

The Prime Minister's Taskforce on Manufacturing was established in 2012 to explore Australian manufacturing (DIISRTE 2012). One of the important messages of the report generated by the taskforce was to keep Australian manufacturers within the country. The taskforce report also highlighted the importance of efficient supply chain operations, but did not provide any direct path in terms of how to realise the suggested direction. Similarly, the outcomes of the taskforce focused largely on government support and intervention, yet did not propose a business strategy as a self-sufficient organisational fulfilment (DIISRTE 2012).

The Australia Institute (TAI 2016) published a report stating that Australia should keep and sustain its manufacturing sector, and referred to statistical evidence to confirm that, when countries properly orient their economic, trade and technology policies, even high-wage countries can maintain the economic output of their manufacturing sectors at a high level (TAI, 2016). If other high-wage countries are able to maintain their manufacturing sector at a high level, Australia should be able to do the same. In 2014, the following countries' manufacturing sectors contributed the following rates to total employment:

- Czech Republic: 26.1%
- Slovak Republic: 21.6%

- Hungary: 19.2%
- Germany: 17.5%
- Korea: 16.9%
- Japan: 15.0%
- Austria: 14.7%
- Switzerland: 14.0%
- Finland: 13.7%
- Sweden: 12.3%
- US: 10.2%
- Australia: 8% (TAI, 2016).

As stated by The Australia Institute (TAI 2016 p. 7): ‘several developed, high-wage countries such as Germany, the Netherlands, Japan, and Korea have all successfully expanded their participation in global manufacturing trade’. The report of TAI (2016) also highlighted the incorrect assumption which indicates that the manufacturing operation of remote and small domestic countries such as Australia would be unfeasible, because several other remote and small economies around the world have outperformed Australia in manufacturing activity (TAI 2016).

Regarding overseas reports, in the US, Congressman Frank Wolf (Republican, Virginia) launched the *Bring Jobs Back to America Act* (HR 516) in 2010, with the inclusion of the ‘total cost of ownership’ concept (Moser 2011). In the US, there is great government support to reshore productions, with the support of dozens of industry articles, webinars and presentations. In support of the above Act, the ‘Reshoring Initiative’ was launched with the assistance of total cost of ownership (TCO) software to calculate the real cost of offshoring, including hidden costs (Moser 2011).

In 2015, the International Economic Development Council (IEDC) in the US, also published a report on the topic of reshoring to retain companies and attract foreign direct investment, which helps companies in their reshoring activities and indicates how to promote foreign companies to make investments in the US (IEDC 2015). In the US, increasing numbers of publications and activities prove the idea of reshoring (Arlbjorn &

Mikkelsen 2014; Holstein, 2010; Kinkel 2011). Other authors have discussed new manufacturing models to successfully compete in high-labour-rate markets (Arika 2013; Borkes 2013; Ellram 2013; Garza 2013; Gray et al. 2013; Eurofound 2017; Fel & Griette 2017; Foerstl et al. 2016; Fratocchi et al. 2016; Sarder et al. 2014; Wiesmann et al. 2017). Appendix I summarises the literature on local manufacturing, local sourcing, manufacturing closer to the end-user, onshore manufacturing, reshoring, backshoring, risk in global sourcing and offshore manufacturing, and rightshoring. As discussed by Moser and Lang (2011), Table 2.3 illustrates the industries with published cases representing the reshoring trend in the US.

**Table 0.4: Industry-based Ranking among Reshored Organisations in the US (Moser and Lang, 2011)**

Industry	Number of cases
Electrical equipment, appliances and components	46
Miscellaneous	19
Transportation equipment	34
Machinery	21
Furniture	12
Computer and electronics	25
Plastics and rubber	16
Fabricated metal parts	16
Clothing and textiles	4
Food and beverage	4
Primary metal, food and beverage	2 each

Table 2.3 illustrates the fact that more manufacturers have decided to reshore their firms in the electrical and transportation equipment industries, as well as in the machinery, computer and electronics industries. These industries represent the group of manufacturers in which product innovation is more frequent, product design frequently changes and quality is important. As stated by Moser and Lang (2011 p. 26), in the US:

the mission of this non-profit organization is to bring good, well-paying manufacturing jobs back to the United States by assisting companies to more accurately assess their total

cost of offshoring, and shift collective thinking from offshoring is cheaper to local reduces the total cost of ownership.

Moser and Lang argued that it is in companies' self-interest to reshore American manufacturing jobs that were lost because of corporate failure to recognise the total cost of offshoring. According to Moser and Lang (2011), most organisations who consider going offshore calculate the comparative price as part of the purchased price, which is an average of 77% of the TCO. Even the landed cost calculation, including product cost, shipping cost, custom fees, different risk factors, compliance and safety stock, over had cost (such as due diligence, travel and exchange cost), which is chosen by most offshore planning projects, is unable to determine the accurate future expenses of an offshore production because it only examines 87% of the TCO. In agreement with Moser (2011) and the Reshoring Initiative's research, the TCO calculation is more appropriate in terms of calculating the expected cost of an offshore operation, compared with the total landed cost or purchase price cost. Table 2.4 illustrates the reasons why some reshored businesses decided to move their operations back to their homeland.

**Table 0.5: Most Common Reasons to Reshore Plants (Moser and Lang, 2011)**

<b>Reasons for reshoring companies</b>	<b>Number of cases</b>
Wage and currency changes	72
Quality, warranty and rework	51
Freight cost	44
Delivery	43
Travel cost	38
Inventory	26
Intellectual property loss or risk	25
Total cost	22
Communications	20
Image, brand (prefer US)	17
Difficulty of innovation and product differentiation	10
Loss of customer responsiveness	9
Price	7
Natural disaster risk	6
Environmental considerations	4

Government incentives	4
Burden on staff, political instability, personnel risk and regulatory compliance	3 each

As seen in Table 2.4, the most important reasons for reshoring are based on wage and currency exchanges, quality and warranty problems, increased freight costs, unreliable deliveries, increased inventory, intellectual property loss or risk, misleading total cost calculations and difficult communications (Hartman et al. 2017; Moser 2011; Saccani et al. 2017). This research will provide more insight into the areas that the Australian Government taskforce examined as part of its report by identifying the advantages of onshore manufacturing combined with agile supply chain management.

## **2.7 Different Successful Management Philosophies in Operation and Supply Chain Management**

This section illustrates the different types of management philosophies and strategies in operation and supply chains via demonstration of various successful cases around the world. However, to better understand recent supply chain operations, the first subsection examines the difference between functional and innovative products.

### **2.7.1 Difference between Functional and Innovative Products**

Before exploring the literature in this particular area, it is important to consider the work by Fisher (1997), Hull (2010) and Elliott and Percy (2007), who provided comprehensive and seminal research comparing functional and innovative products. It is vital to understand the difference between functional and innovative products to be able to identify the required supply chain solution. In identifying approaches to increasing supply chain effectiveness and performance, Fisher (1997) asked the simple question of whether a product is functional or innovative. In defining the two approaches, Fisher (1997 p. 106) stated that:

Functional products include the staples that people buy in a wide range of retail outlets, such as grocery stores and gas stations. Because such products satisfy basic needs, which don't change much overtime, they have stable, predictable demand.

As a result of the regular purchasing of these products by consumers, demand is relatively stable and predictable, which makes production easier to forecast and manage. However, because of these same factors, these products tend to generate greater competition, which typically results in lower margins. The following table demonstrates the work by Fisher (1997) comparing innovative and functional products to understand their main features in order to differentiate them and subsequently establish the foundation for the theoretical framework of this study.

**Table 0.6: Features of Innovative Versus Functional Products (Adopted from Fisher 1997)**

<b>Product type</b>	Innovative product	Functional product
<b>Meaning</b>	Complex product/many variations in finished product	Standardised product
<b>Production strategy</b>	Made-to-order	Made-to-stock
<b>Product lifecycle</b>	Three months to one year	More than two years
<b>Lead time required to produce made-to-order</b>	One day to two weeks	Six months to one year
<b>Demand</b>	Unpredictable	Predictable
<b>Adapting management philosophy</b>	Agile domination (lean until early decoupling point)	Lean domination (agile after late decoupling point)
<b>Adapting management philosophy in volatile business environment</b>	Responsive supply chain	Effective supply chain
<b>Geographical perspective</b>	Closer to end-user/ultimate customer	Global sourcing does not have a negative effect
<b>Decoupling point</b> <ul style="list-style-type: none"> <li>• between agile and lean management</li> <li>• between semi-finished and finished products</li> </ul>	Early stage of production	Late stage of production

Table 2.5 indicates the differences between innovative and functional products. Fisher (1997) stated that innovative products—with their high profit margins and volatile demand—require different supply chains than do highly predictable functional products. To understand the difference between functional and innovative products, two types of functions must be differentiated within a supply chain: physical function and market mediation. Physical function includes all the production, transportation and other costs of

converting raw materials to finished goods. The market mediation cost is only visible when the actual demand is more or less than the supply. The predictable demand of functional products means that market mediation operates smoothly because demand and supply are almost equal. In that instance, the supply chain focuses only on minimising physical cost as the essential goal of a cost-sensitive functional product (Kara et al. 2014). This supports the supply chain to apply manufacturing resource planning software, which assists in scheduling orders and production and delivery of supply, and enables organisations to minimise inventory and maximise production efficiency. Innovative products—with their unpredictable demand and short lifecycle—increase the risk of shortage of supply; hence, the predominant cost of innovative products is always the market mediation cost (Singh 2015; Singh et al. 2017). The most important issue in supply chains dealing with innovative products is to realise early sales numbers and different market signals, and to react quickly because the product lifecycle is quite short (Fisher 1997; Kara et al. 2014; Lo & Power 2010; Singh et al. 2017).

Functional products are standardised products that usually satisfy a basic human need. They do not change much over time; have a long lifecycle; and have stable, predictable demand (Frochlich & Westbrook 2001; Lambert & Cooper 2000; Simchi-Levi 2005). The production strategy for functional products is usually ‘make-to-stock’, with the lead time required for producing made-to-order products varying from six months to one year. The product lifecycle is more than two years and demand is usually predictable.

Innovative products are usually complex products with many variations in the finished product. The production strategy is ‘make-to-order’, the production lifecycle is three months to one year, the lead time required to produce made-to-order products is one day to two weeks, and demand is usually unpredictable (Chopra & Meindl 2007; Simchi-Levi 2005). Although innovative products ensure companies will achieve a higher profit margin than with functional products, innovative product demand is usually unpredictable. Further, for the purpose of sustaining a competitive advantage, companies are forced to introduce a continuous stream of new innovation. The short lifecycle and large variety of these products further increases unpredictability (Fisher 1997; Lo & Power 2010).

As Fisher (1997) further discussed, companies with innovative products can obtain greater reward by investing high responsiveness throughout the supply chain than by improving efficiency. Responsive supply chains mean they respond quickly to unpredictable demand; deploy buffer stock in parts and finished goods; invest aggressively in reducing lead time; use modular design to postpone product differentiation for as long as possible; and prefer speed, flexibility and quality throughout the entire supply chain (Lambert & Cooper 2000; Lee et al. 1997; Porter 2008). To combat potentially lower margins, firms look towards innovative products. Innovative products provide consumers an ‘additional reason to buy their products’ (Fisher 1997 p. 106). However, the downside of innovative products is that there is an unpredictable element to the demand, and innovations are rapidly eroded because competitors are quick to imitate those once-innovative products (Drake et al. 2013; Lo & Power 2010).

A further relevance of Fisher’s (1997) work is that firms need to strike a balance between the two types of products to gain the greatest market share. Specifically, Fisher (1997, p. 108) highlighted that the important consideration is:

where in the chain to position inventory and available production capacity in order to hedge against uncertain demand. And suppliers should be chosen for their speed and flexibility, not for their low cost.

Fisher also proposed a basic matrix to identify how firms are able to obtain the most out of their supply chain, comparing functional and innovative products, and whether an efficient or responsive supply chain is preferred. This matrix is displayed in Figure 2.4.



Supply Chain Matrix		
		Functional Products      Innovative Products
Efficient Supply Chain		Match
		Mismatch
Responsive Supply Chain		Mismatch
		Match

**Figure 0.4: Supply Chain Matrix (Fisher, 1997)**

Using the matrix proposed by Fisher (1997) and replicated above, firms are able to identify whether the process the firm uses to supply products is well suited to the product type—specifically, they should use an efficient process for functional products and a responsive process for innovative products. This has significant implications for adopting efficient or responsive processes, and whether these processes should be outsourced or kept onshore (Fisher 1997; Kara et al. 2014; Lo & Power 2010; Singh et al. 2017).

### 2.7.2 Organisational Agility Versus Flexibility

In reviewing the literature about supply chain management, operation, production, manufacturing, agility and flexibility, an emerging question arose: what is the difference between ‘agility’ and ‘flexibility’? It is important to know which term is appropriate to describe supply chains for this research project. Thus, this section examines the difference between the two terms and clearly distinguishes them from each other.

In accordance with Goldhar & Jelinek (1983) view, flexibility arises from the concept of coping with environmental uncertainties and producing variability in outputs. Flexibility was developed from the view of economies of scope, as opposed to the view of economies of scale, which is based on the practice of mass production (Goldhar & Jelinek 1983). The

early explanation of flexibility was the ability to respond effectively to changing circumstances (Mandelbaum 1978). However, flexibility has always had a correlation with machine and labour flexibility (Buzacott 1982); thus, flexibility has been mostly applied at the operational level (Baker, 1996). As Slack (1987) further discussed, organisational flexibility is synonymous with strategic flexibility. Further, strategic flexibility refers to the ability of a firm to switch from one strategy to another.

Agility has been applied to production, operation and supply chain practices since organisations realised its necessity to achieve major changes, serve customer demand efficiently, cooperate to increase competitiveness and utilise the impact of industrial knowledge and information (Goldman et al. 1995). Agility was implemented at the strategic level of an organisation or supply chain. According to Goldman et al. (1995), an agile company can support different structural parts of the organisation simultaneously. Moreover, agility emerged in the period when market fragmentation increased, the made-to-order concept was gradually arising, product lifecycles were shrinking, greater customisation was necessary, globalisation arose and environmental turbulence became more common. Under these circumstances, the appropriate strategy to deal with turbulence was to reconfigure operations to serve individual customer specifications; thus, firms had to transform their strategy from mass manufacturing to mass customisation (Pine 1993).

Ben Naylor (Naylor 1996) at Cardiff University posited his thesis on ‘agility’. He not only investigated the agile concept, but also differentiated agile from flexible manufacturing systems. He also distinguished agile and lean philosophies from each other. According to Naylor (1996), agility means using market knowledge and a virtual corporation to venture profitable opportunities in a fluctuating marketplace, while the lean objective is to develop a value stream to eradicate all waste, including time, and to secure the adequate inventory level. Agile manufacturing deals with fluctuating customer demand and rapid arrangement of goods. Although, agile manufacturing eliminates the necessary waste, but contrary to lean management, eliminating waste is not the primary focus on agility. Hence, the supply chain will be flexible, yet not through lean activities, but through a mixture of lean and agile approaches (Naylor et al. 1999).

According to Baker (1996 p. 6), as illustrated in Table 2.6, ‘a major difference between agility and flexibility is that agility places far more emphasis on the higher levels in the hierarchy’. Thus, agility focuses more on the strategic level, while flexibility mostly relates to the operational level of an organisation or supply chain. Hence, the two approaches should be applied as complementary, rather than mutually exclusive. In addition, agility involves both range and response dimensions simultaneously, whereas flexibility can be one, the other or both (Baker 1996).

**Table 0.7: Framework of Positioning Agility and Flexibility (Adapted from Baker 1996)**

Level	Dimension	
	Range	Response
Business network	Agility	
Organisation		
Core process		
Sub-process	Flexibility	
Resource		

The significance of this table is to distinguish the terms of agility and flexibility, and select the appropriate approach to secure the meaning of this topic for this research. After brief discussion, agility was the chosen focus, as this study focuses more on the organisational level of an operation or supply chain than on the operational level. When companies need to review their capabilities and resources frequently, or need to adjust their business strategies regularly, this is achieved through the organisational level, rather than the operational level. In addition, in terms of the importance and main aspect of agility, this research focuses on the agility drivers of the whole supply chain at the operational level, which suggests frequent executive revision of the business strategy, resources and capabilities of the core company and its partner from the supplier’s supplier to the end-user. Further, the principle of agility, stated by Yusuf et al. (1999), and the conceptual model of an agile enterprise link back to the research question and to the main standpoint of this study. Hence, these characteristics will be explored by this research to determine whether organisations apply agility before deciding to go offshore, and whether agile supply chains assist those companies who remain onshore.

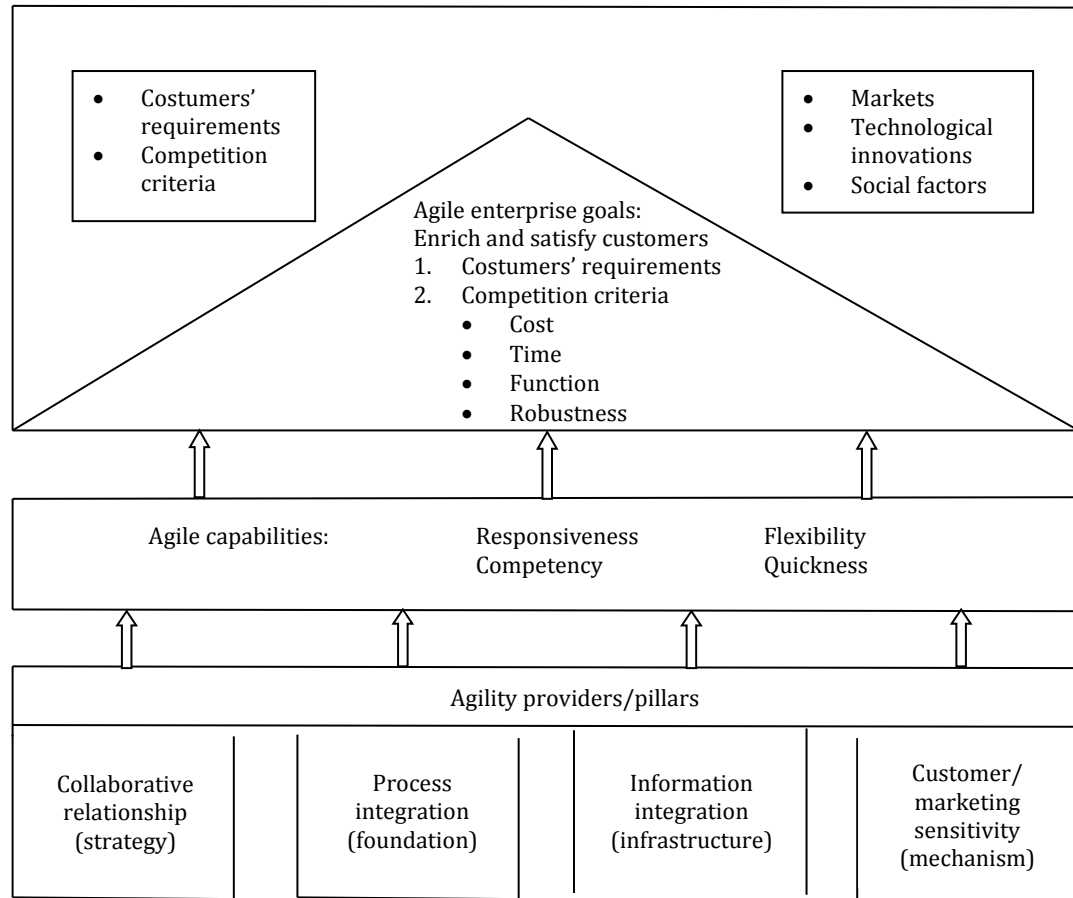
As stated by Tseng and Lin (2011 p. 3706):

for an enterprise to achieve agility, it is critical to align and integrate agility providers, capabilities and drivers to ensure that the agility providers can satisfy the agility capabilities and the agility capabilities can cope with agility drivers, transforming them into strategic competitive edges.

According to Gunusekaran et al. (1999), the characteristic of agile principles are as follows:

- high-quality and highly customised products
- products and services with high information and value-adding content
- mobilisation of basic competencies, and responsiveness to social and environmental topics
- synthesis of diverse technologies
- feedback to change and uncertainty
- agile activity within the organisation and through the whole supply chain.

The main driver of agility is the volatile and continuously changing market environment (Malakouti et al. 2017; Qrunfleh and Tarafdar 2013). Change is always modifying human behaviour; thus, there is nothing new about change, yet change is happening more frequently than ever before (Tseng and Lin 2011). Moreover, ‘Turbulence and uncertainty in the business environment have become the main cause of failure in enterprises. Achieving agility requires responsiveness in strategies, technologies, personnel, business processes and facilities’ (Tseng & Lin 2011 p. 3697). The characteristics, numbers and circumstances of change vary case by case; hence, change can rarely be predicted. Even the same agile process or risk-management strategy cannot be applied in similar enterprises because of the different characteristics of the business environment and operation strategy. For the purpose of achieving absolutely agile operation, firms should continuously be sensible and responsive to changes, and should implement several agility drivers. Figure 2.5 is a conceptual model adapted from Tseng and Lin (2011) that visualises an agile enterprise.



**Figure 0.5: Conceptual Model of an Agile Enterprise (Adopted from Tseng & Lin 2011)**

As Figure 2.5 describes, enterprises should first build their agility pillars with the requested agility providers, such as collaborative relationships, process integration, information integration and customer/market sensitivity. The agility pillars are the foundation of the agility capabilities of responsiveness, competency, flexibility and quickness. Further, agile enterprise goals should be determined for the purpose of enriching and satisfying customers with the considerations of cost, time, function and robustness, which have to serve the agility drivers, such as customer requirements, competition criteria, market requirements, technological innovations and social factors under the changing competition of the business environment.

Decades before the term ‘agility’ started to become relevant, uncertainty was an important issue for management research. In 1967, Thompson (1967) argued for the relevance of managing uncertainty in terms of business operations, and that the most important task for any organisation is to manage uncertainty. Others researchers, such as Drucker (1968), explained the approach of enterprising responsibility as the continuous search for changes, response to changes, and application of changes as opportunities. With agile operations, organisations set their objective to adapt to changes in the environment, while agility also helps generate profit from rapidly changing, continually fluctuating markets because it forces high performance and high quality through continuous change (De Vor et al. 1997; Goldman et al. 1995). Appendix II presents a table of various previous research studies on the topic of agility.

The most important feature of the above mentioned studies in terms of this research is the taxonomy of ‘agility drivers’, as Figure 2.5 describes. Agility drivers were developed based on a conceptual model of agility, whereas a manufacturing unit experiences several changes in the business environment that highlight the ‘agility capabilities’ that need to be arranged according to the requirements of continuous changes in the market (Tseng & Lin 2011). This places pressure on business units to enforce new manufacturing practices (‘agility providers’) to achieve the required capabilities. Further discussing Tseng and Lin’s (2011) statement about organisational agility, Zhang and Sharifi (2007 p. 353) expressed a similar view:

Agility capabilities represent the set of capabilities that need to be chosen and prioritised to form the ‘task’ in the strategy. Agility providers are a specialist set of tools and practices from which ‘choices’ in the strategy could be developed.

Further, as Tseng and Lin (2011) stated, although organisations are aware of the importance of agility, as well as mindful about the essential approaches and steps to achieve agility, there is still no organised tool for integrating and approaching the issues of alliance among these steps. In agreement with Fantazy et al. (2009), for the purpose of achieving competitive advantage and serving customer demands rapidly, organisations should invest resources, energy and time to develop suitable flexibility approaches to harmonise their strategies. To accomplish this requirement, firms must continuously meet the maximum

expectation of their product flexibility and delivery flexibility (Fantazy et al. 2009), which would help them achieve long-term competitive advantage.

Given that the terms 'lean' and 'agile' both have an important role in supply chain management and production and are generally discussed mutually in the supply chain and production literature, the next section examines the differences and connections between them.

### **2.7.3 Lean, Agile and Leagile**

While a lean supply chain reacts to short-term forecasts, agile management has the intention of producing only when demand already exists, when products are already sold or placed, and to enable make-to-order replenishment (Goldsby et al. 2006). Naylor et al. (1999) combined the terms 'lean' and 'agile' to create the word 'leagile'. This strategy is often referred to as a mixed-model technique in the manufacturing context (Goldsby et al. 2006). Based on Naim and Gosling (2011), lean supply chain management is viable when the lead time is not important and demand is predictable, an agile supply chain is required when demand is unpredictable, and a leagile chain is needed when lead times are long and customers are able to wait until the product is customised.

Applying lean and agile principles to every part of the supply chain can have a huge effect on the performance of the whole system, and can emphasise the importance of an effective and efficient business (Mason-Jones et al. 2000; Browaeys & Fisser 2012; Drake et al. 2013; Galankashi & Helmi 2016). The combination of lean and agile models maintains a new way of thinking in the context of supply chain management. A flexible and quick response to market demands in conjunction with a lean paradigm are mutually opposing principles (Naim & Gosling 2011, Eltawy & Gallear 2017). While an agile approach aims to have a quick and flexible effect on a firm's operations, a lean approach has the responsibility of eliminating waste and cutting costs wherever it can (Duarte et al. 2011). If lean and agile approaches are operated wisely with a decoupling point, organisations can achieve competitive advantage in their business environment (Eltawy and Gallear 2017).

Further, regarding product types and implementing the appropriate supply chain, high-volume and low-demand uncertainty products should be matched with efficient processes and lean supply, whereas low-volume and high-uncertainty products should be matched with flexible processes and agile supply chains. Medium-volume and medium-demand uncertainty products should use leagile supply chains that employ a combination of efficient and flexible processes (Stavrulaki and Davis, 2010, Galankashi and Helmi, 2016). A major problem of most supply chains is their limited view of real demand. When seeking to obtain good visibility, keeping the inventory as low as possible, and achieving greater responsiveness to the market, lean and agile principles should be implemented with a decoupling point at the appropriate stage of production (Christopher & Towil 2000; Eltawy & Galleary, 2017).

Even if high-level agility (Bhatnagar & Sohal 2005; Choi & Krause 2006; Faisal et al. 2006; Holweg et al. 2011;) has been implemented in the supply chain, flexibility can be impossible because of a complex global sourcing strategy. To approach the problem from a different perspective in terms of inflexibility in global sourcing, according to Butner (2010), building a supply chain that focuses only on effective operations and demand-driven achievements is no longer feasible. Today, businesses need to be smart and agile in terms of quick reactions to rapidly changing market conditions. For this reason, several organisations have switched their management philosophy to agile/agile supply chains that are adaptable to a fluctuating business environment; however agility is noticeably more effective within onshore operations context (Butner 2010; Christopher 2000; Christopher & Holweg 2011; Christopher & Towil 2000; Eltawy & Galleary 2017; Fayezi et al. 2015; Malakouti et al. 2017; Tseng and Lin 2011; Vázquez-Bustelo & Avella 2006; Zhang 2011).

Among several views on how to achieve competitive advantage, according to Prater et al. (2001), firms should build a membership within a strong regional sectoral system, with local sourcing possibilities. In this case, collaboration and common goals could improve the cost of goods and materials, as well as the service parts of the supply chain. Several other researchers have emphasised their own views on how to increase a firm's chances in a supply chain to achieve competitive advantage, such as implementing lean (Agus & Hajinoor 2012; Alves et al. 2012; Myerson 2012, Kumar et al. 2012; Phelps et al. 2004;



Pagani 2004; Schniederjans et al. 2010), agile (Ismail & Sharifi 2006; Liu et al. 2010; Mason-Jones et al. 2000) or leagile management (Browaeys and Fisser 2012; Castro et al. 2012; Goldsby et al. 2006; Naim & Gosling 2011; Naylor et al. 1999). These authors stated that organisations—particularly in the innovative sector—should consider implementing lean and/or agile management before going offshore. Considering that frequent inventors need resilience in terms of responding to their final customers rapidly after every release of their new products, long distances can be highly disadvantageous to their operations (Mistry 2005; Pagani 2004).

In summary, reflecting on the main research question, according to the literature, agile supply chains are able to provide a long-term competitive advantage to those manufacturers who produce innovative products, which are characterised as having unpredictable demand, being customised and having a short lifecycle. This section of the study also highlighted that organisations should wisely choose a decoupling point when combining lean and agile principles, so they can achieve mutually efficient and flexible processes. Additionally, the literature suggests that firms should try implementing agile and lean activities before considering moving offshore.

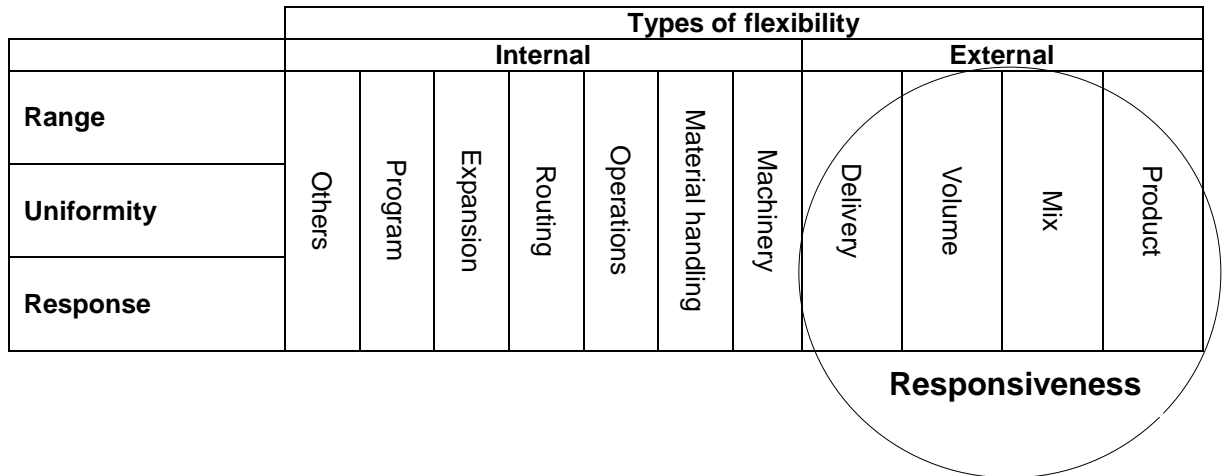
#### **2.7.4 Relationship between Flexibility and Responsiveness**

Flexibility makes an extensive contribution to manufacturing (de Toni & Tonchia 1998; Garavelli 2003; Gerwin 1993; Reichart & Holweg 2007; Upton 1994). Furthermore, Reichart and Holweg (2007) most clearly summarised the definition of flexibility as the ability of any system to adapt to internal or external influences, thereby acting or responding to achieve a desired outcome. Further, Slack (1987) identified four types of flexibility: product, mix, volume and delivery. As Lummus et al. (2003) described, flexibility can be extended beyond organisations' boundaries to serve an entire supply chain. Further, in agreement with Slack (1987), Upton (1994) and Garfamy (2006), a system's flexibility can differentiate two type of flexibility: internal and external. Internal resources can be adopted to achieve different types of internal flexibility, which can reinforce the system's ability to determine external flexibility to its environment. External flexibility can concentrate on short-, medium- or long-term goals, which require

operational, tactical or strategic internal flexibility to achieve. Those internal and external flexibilities can also be extended to an entire supply chain (Garfamy 2006; Upton 1994).

According to Reichart and Holweg (2007), there is a clear connection between organisation/supply chain agility and responsiveness in manufacturing and supply chain systems. Matson and McFarlane (1999 p. 765) defined production responsiveness as ‘the ability of a production system to achieve its operational goals in the presence of supplier, internal and customer disturbances’. Those disturbances relate to the three types of uncertainty: supply, process and demand uncertainty. Hence, a manufacturing system is more responsive if it can deliver the same product in a shorter lead time. Singh (2015) also defined responsiveness as the ability of organisations to adapt to the changes and requests of the marketplace. Further, Catalan and Kotzab (2003 p. 677) defined the responsiveness of a supply chain ‘as the ability to respond and adapt time-effectively based on the ability to “read” and understand actual market signals’. Thus, any system can be called responsive if it can adapt to changes faster than normal operation. Consequently, responsiveness should be contemplated as a concept that is purely customer focused (Reinhart & Holweg 2007).

Figure 2.6 illustrates the areas in which responsiveness should be applied within an organisation, and demonstrates the relationship between flexibility and responsiveness based on the flexibility dimensions identified by Slack (1987) and extended by Upton (1994). Figure 2.6 also explains and incorporates the four external and various internal flexibility types discussed above. This figure also explains the background of flexibility drivers. The external flexibility of an operation has a direct relationship with responsiveness and supply chain operations. Unlike internal flexibility, external flexibility also has a connection with the resources and capabilities of the organisation, which are the main aspects to consider when companies need to reassess their business strategy.



**Figure 0.6: Relationship between Flexibility and Responsiveness (Adopted from Reichart & Holweg 2007)**

The responsiveness of a producer or supply chain system is determined by the speed with which the system can adapt its productivity within the four external flexibility, e.g. product mix, volume, delivery and customer order (Reichart & Holweg 2007). As such, as indicated in Figure 2.6, organisations need to use their flexibility to provide prompt responses in regard to product demand, product mix demand (exact proportion of product mix), the volume of each product on demand, and prompt delivery on demand. These are the activities that need to be promptly responded to within the organisation, which enables the organisation to be responsive.

As firms aim to achieve the ultimate goal of market-oriented and financial success, they always need to review their organisational and supply chain performance (Li et al. 2010). To improve the performance of the organisation, supply chain performance must also be improved (Gunasekaran et al. 2008). According to Wu et al. (2006), supply chain responsiveness, the correct arrangement of goods and information, and inter-firm activity integration can potentially improve organisations' financial and market performance. Liao et al. (2010) argued that the higher degree of flexibility applied to the supply chain, the more successfully it can adapt to changes in the market. Further, Christopher (2000), Guansekaran et al. (2008) and Yusuf et al. (2004) argued that agility is the foundation to build the ability of the supply chain to respond more rapidly to changes in demand, which also improves supply chain responsiveness. Tarafdar (2013) stated that supply chain

responsiveness is increased by the presence of an agile supply chain strategy, and supply chain responsiveness is positively associated with a firm's high performance. Moreover, agile supply chains allow firms to respond quickly to short-term changes in volatile markets and handle uncertainty in the market (Malakouti et al. 2017). According to Fisher (1997 p. 107):

the economic gain from reducing stock outs and excess inventory is so great that intelligent investments in supply chain responsiveness will always pay for themselves—a fact that progressive companies have discovered.

For example, in the last few decades, several manufacturers around the world decided to continue producing in-house certain high-variety, innovative products with short lifecycles, rather than outsourcing them to a low-cost Asian country, because local manufacturing gave the company the advantages of increased flexibility and shorter lead times (Bettiol et al. 2017; Bhatnagar & Sohal 2005; Faisal et al. 2006; Holweg et al. 2011; Oberg et al. 2017;). The information above directly responds to the main research question. This is further examined in the data collection and analysis, and interpreted in the conclusion section of this thesis in Chapter 8.

## **2.8 Summary of Literature Review**

This detailed literature review helped develop the main aspects of this study, including the following. In terms of Australian manufacturers, during the last few decades, there has been a certain trend to produce offshore, which is contributing to a continual decline in the number of Australian manufacturers and employees. In contrast to the decline in Australia, there are increasing numbers of backshoring cases (also known as reshoring, or returning from low-cost countries), mainly in the US and Europe, because certain manufacturers have realised that proximity to the market, with the combination of responsive production, is outweighing the benefits gained from products supplied from distant low-cost countries.

Comparing studies relating to the advantages and disadvantages of global sourcing, and reviewing Australian manufacturers 'best-practice' on this topic, provided the possible

knowledge gap to be identified. Table 2.8. illustrates the details of the identified knowledge gap.

**Table 0.8: Knowledge Gap: Benefit and Disadvantage of Global Sourcing and Offshore Manufacturing**

<b>Different view of the research</b>	<b>Author/Title</b>	<b>Research outcomes</b>	<b>Summary of the different findings</b>
Disadvantages of Global sourcing and Offshore manufacturing	Christopher, Holweg, 2011, Supply Chain 2.0: managing supply chains in the era of turbulence	Volatility in the business environment has increased significantly and is very likely to continue in the future. Organisations used to aim for efficiency through “optimized” supply chains, but now it is important to build supply chains that are adaptable to turbulence. ‘Low-cost country advantage’ generally outweighs the transportation cost in global supply chains no longer holds.	As a response to volatile business environment, build agile, responsive supply chain closer to end-user should be considered in several cases. Offshoring often isn’t the right strategy for companies whose competitive advantage comes from speed and a track record of reliability. . ‘Local for local’ production, and ‘near sourcing’ strategy should be considered in several cases. Manufacturing executives should think of becoming lean, agile or leagile before leaping offshore. High variant, innovative products tend to be less suitable for global sourcing.
	Ritter, Sternfels, 2004, When offshore manufacturing doesn’t make sense	Too many organizations overestimate the savings to be had from going abroad and fail to recognize the problems, such as dealing with inventory, obsolescence, and currency exchange rates. Many manufacturers may be better served by staying at home – particularly if they successfully implement lean, agile or leagile -manufacturing or other initiatives that drastically lower the negative effect of labour cost.	
	Pagani, 2004, Manufacturing execs should focus on becoming lean before going offshore	Recently, there is a trend towards offshore production and sourcing may be reversing. Quite a number of manufacturers have realized that off-shoring may not be as advantageous as previously thought. This is probably because they did not consider factors other than monetary costs.	
	Holweg, Reichhart, Hong, 2011, On risk and cost in global sourcing	Many global sourcing ventures do yield less than expected benefit – or are in fact not economically viable – due to unexpected hidden and dynamic costs. As the demand uncertainty is often driven by product variety, high-variant products tend to be less suitable for global sourcing.	
	Williams, 2009, International sourcing: Offshore or Near-shore?	Three/quarters of major US companies currently sourcing internationally have made changes or are planning to make changes to alter supply chains to source closer to home. Advantages are shorter, more reliable delivery time, lower shipping cost, to get relief from cost of late deliveries, cost of getting the product to distributors and intellectual property issues, as well as warranty and safety costs.	

Advantages of Global Sourcing and Offshore Manufacturing	Edgell et al. 2008, Global sourcing trends in 2008'	Global purchasing has become an increasing trend worldwide because it is associated with economic development .When seeking competitive advantage, firms take every potential opportunity to increase their profits and satisfy their customers' requirements. The fundamental goal of global sourcing is for the firm to take advantage of both local and global marketplaces.	Making the decision to source globally derives from the intention to improve the firm in several ways. The main benefits of international sourcing are the following: the possibility of presence on foreign markets, lower wages, possible quality improvements, the ability to acquire resources not available in the home country, increased knowledge of worldwide technology, global presence of the firm, low-cost raw materials, low-cost components or final products, and reduced commercial barriers
	Kotabe and Murray 2004, Global sourcing strategy and sustainable competitive advantage	Competition in the market provides advantages for customers, such as lowering price and increasing quality. It also creates a sustainable competitive market between rivals. In this regard, to achieve competitive advantage, several Australian manufacturers have decided to adopt global sourcing or offshore manufacturing to benefit from Australia's geographical proximity to low-cost Asian countries, which can, in many cases, make Australian offshore manufacturing even more viable	
	Holweg et al. 2011, On risk and cost in global sourcing	The main incentive for a firm to go global is market expansion and the advantage of decreased product price. Further, another aspect of international sourcing is that companies are able to enlarge their marketplaces, and can attain the ability to generate products wherever customers require.	
	Weber et al. 2010, Low cost country sourcing and its effects on the total cost of ownership structure	Global competition leads to shortening the lifecycle of most products, as multinational companies satisfy their customers more frequently.	

The conclusion of the table is that for some companies, the best way to streamline supply chain will be to bring manufacturing and sourcing closer to home. For others this may not be the best solution. A broad range of factors related to each company's specific situation will dictate those needs. This study determines whether there is any particular type of manufacturer that can stay local and whether agile operations add value to those manufacturers that decide to stay onshore.

Companies should collaborate within the supply chain and share information to work efficiently and achieve a high level of responsiveness. The literature and several cases around the world suggest that agility and responsiveness—the key factors in today's

business—are rarely viable from a geographically far distance because these long distances create supply and production inefficiencies, and increase logistical and inventory costs. A long-distance supply is unable to serve the main aspect of responsiveness—time. Responsive supply chains are generally applied by innovative product manufacturers; thus, the importance of proximity to the market for innovative product manufacturers is more crucial than for mass manufacturers.

The lesson learnt from the literature review is that enterprises today need to apply agility and responsiveness to gain long-term success, and should look beyond the product price (landed cost) of a planned offshore operation before deciding to move production offshore. The findings of the literature review also reflect and provide answers to the research question. This research is important because it views the onshore and offshore debate from a different angle, and explores different operation and production strategies, while differentiating the two main types of manufacturers. In the next chapter of the study, the findings of the literature are incorporated to assist in developing the theoretical framework.

## **Chapter 3: Theoretical Framework**

### **3.1 Introduction**

This chapter explores existing research and theory to provide an interpretative lens to answer the research question: how can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user? This exploration starts with a search of existing theories in the operation and supply chain management area.

This chapter presents a conceptual model of a viable onshore agile supply chain for frequent innovators in the Australian manufacturing sector, for the purpose of achieving a conceptualised conclusion. The process, outcome and research question of this research will be supported by the theoretical framework discussed below.

This chapter outlines the selection of research theories and theoretical framework to be used in this study. Section 3.2 presents the theory selection process and Section 3.3 discusses the background and relevance of dynamic capabilities (DC) theory. Section 3.4 summarises the background and relevance of the TCO, while Section 3.5 presents the theoretical framework.

### **3.2 Theory Selection Process**

By identifying gaps in the literature, as presented in Chapter 2, this study was able to develop a conceptual lens to detect issues of flexible supply chain solutions to be integrated into onshore manufacturing, before manufacturers decide whether to stay onshore or go offshore. A brief review of the different theories in operation and supply chain management highlighted that three theories have been used more frequently than others. The most commonly used theories to support the operations and supply chain framework are resource-based view (RBV), transaction cost analysis (TCA) and Porter's five market forces (PFMF). According to the literature review on the theories involved in business research, these three theories have been largely applied to studies reflecting the debate



surrounding geographical distance in sourcing and production since the early 1980s, when RBV, TCA and PFMF were developed and used by several other researchers.

Although these theories seemed appropriate for this research and for investigating the research question, in the process of reviewing the literature and considering other possible theories, two recent significant and relevant theories emerged. Both Dynamic Capabilities (DC) and Total Cost of Ownership analysis (TCO) were identified in the area of turbulent and unstable business environments. According to Teece et al. (1997 p. 516) DC can be defined as the following: ‘the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments’. However, TCO became the most strategic analysis tool when organisations endeavour to assess all the indirect and hidden costs of an international sourcing opportunity above the transaction cost (Cousins & Spekman 2003).

Both theories had the capacity to be applied in this study, where the research question was sensitive in terms of academic and business-related aspects. Moreover, in recent times, DC and TCO theories have gained much more significance for exploring competitiveness in a volatile business environment (see Table 3.1 and Table 3.3). For the purpose of exploring the advantage of DC and TCO, the features of the original three theories (RBV, TCA and PFMF) was explained, and then, to enable comparison with the original three theories, the benefits of DC and TCO was highlighted.

The RBV states that, if the assets and resources of a firm are employed in distinctive ways, competitive advantage can be achieved (Wernerfelt, 1984, Barney, 1991, Day, 1994, Chen et al., 2009). Researchers have long accepted the RBV in logistics and supply chains, as logistics are critical to a firm’s resource allocation and use (Bowersox et al., 2000). According to Chen et al. (2009 p.31), ‘a resource with the potential to create competitive advantage must meet a number of criteria, including value, rarity, imitability and organization’. Resources and capabilities offer remarkable value if they compel organisations to venture into new opportunities. RBV considers firms to have various different resources. If at least a few of these resources are rare, valuable and difficult to resemble, a company can achieve a sustainable competitive advantage (Chen et al. 2009). These characteristics can be the source of competitive advantage for companies that are

controlling them. Furthermore, resources are distributed differently and the differences in distribution persist over time (Barney, 1991). This can only be the case however if it is assumed that firm's environment is constant and relatively stable (D'Aveni, 1994). In a dynamic business environment on the other hand, this will not hold true, because when companies experience rapidly changing environments, the advantage of a resource might soften or become less important over time, thus the assumptions of the RBV cannot be transferred to such markets (Teece, 2007). According to the above consideration, RBV is not the preferable theory for this research.

TCA has the intention to minimise exchange costs in an organisation at the strategic level, both internally and externally (Tiwana and Bush, 2007). The concept of TCA was established by Coase (1937) and further developed by Williamson (1975, 1981, 1992, 1994). Essentially, TCA was built to express the possibility of the 'make or buy' decision between the firm and market, including consideration of direct, dynamic and hidden costs in this decision (Yazdanparast et al. 2010). Key aspects of TCA include uncertainty, exchange frequency and the level of transaction specificity of the investment (Williamson, 1979). The fundamental elements producing transactional difficulties include environment uncertainties, bounded rationality, opportunism and information impactedness (Cheon et al. 1995; McIvor 2009; Tiwana & Bush 2007). In general, when any of these elements rise, transaction costs increase. Further, in the case of uncertainty and complexity in the business environment, transaction costs are higher. As such, this theory was not suited to the current research because it does not provide full evaluation of a product that is sourced or produced offshore because of the several hidden, invisible and unpredicted costs involved.

In the context of evaluating competitiveness, PFMF theory is another view of how organisations can be competitive by placing themselves in a strong position against competitors (Porter 1979; Porter 1998; Young 2006). Porter (1985) stated that the competitive business environment is affected by five industry characteristics: the bargaining power of buyers, the bargaining power of suppliers, the threat of new entrants, the threat of substitutes and the rivalry among existing competitors. These market forces reduce the potential profit in an industry. In defence against these forces, organisations should position themselves in an industry where the forces are at their weakest points or

where the organisation is least vulnerable (Porter 1998). Overall, using Porter's theory, by reducing cost, differentiating a firm's product and placing the firm in the least vulnerable position regarding the five market forces, competitive advantage can be gained. PFMF does not address issues and solutions to achieve long-term competitive advantage in a volatile business environment (D'Aveni et al. 2010), and doesn't comment in the aspects of DC and TCO, thus it not suit to the current research.

According to the literature review on the theories involved in business research, resource-based view (RBV) and transaction cost analysis (TCA) were the commonly used theories to support the operations and supply chain framework. These three theories have been largely applied to studies reflecting the debate surrounding geographical distance in sourcing and production since the early 1980s, when RBV, TCA and PFMF were developed and used by several other researchers. However for this research and for investigating the research question, in the process of reviewing the literature and considering other possible theories, two recent significant and relevant theories emerged. Both Dynamic Capabilities (DC) and Total Cost of Ownership analysis (TCO) were identified in the area of turbulent and unstable business environments. Both theories have the capacity to be applied in this study, where the research question is sensitive in terms of academic and business-related aspects.

In contrast to the frequent application of RBV, TCA and PFMF in business research, DC and TCO have a stronger theoretical effect on business studies that focus on a volatile business environment (Candace et al. 2011; Mohamud & Sarpong 2016; Pezeshkan et al. 2015). Although DC theory is based on the RBV of a firm, the feature of DC in recent times has assumed much more significance in gaining competitive advantage (Chien & Tsai 2012). DC and TCO were purposefully selected to complement each other because, according to Cox (1999), the complexity of today's supply chain system cannot be explained entirely with a single theory. A single theory may have very limited analytical power; thus, combining these two theories can create a more complete understanding of the issues being explored—the distant sourcing debate of innovative product manufacturers in an uncertain business environment. The conceptual framework of this study was built on the DC theory and TCO analysis. Thus, the following section discusses the background, application, advantages and disadvantages of the DC theory.

### 3.3 Background and Relevance of Dynamic Capabilities

Teece et al. (1997 p. 516) defined DC as ‘the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments’. During the last two decades, rigid competition has driven organisations to reconfigure and recreate their resources and capabilities. When this tendency emerged, it resulted in DC (Eisenhardt & Martin 2000; Teece et al. 1997), which provided an important analytical device in empirical research. Dynamic capability is a well-known term among academics as it is regularly used by researchers since the middle of the twentieth century (Learned et al. 1969; Selznick 1957). In addition, dynamic capability as the term used in operation and supply chain area, was supplemented by other important terms, as organisational routine (Nelson & Winter 1982), architectural knowledge (Henderson & Clark 1990), core competence (Prahalad & Hamel 1990), core capability and rigidity (Leonard-Barton 1992), combinative capability (Kogut & Zander 1992) and architectural competence (Henderson & Cockburn 1994).

In the twentieth century, the most important term for managers in the production industry was ‘optimisation’, rather than satisfying processes and final results (March 1991). In a time of turbulence, organisations should not create ‘once-and-for-all’ solutions and routines, but should continually reconfigure and redesign the organisation’s resources and capabilities. When the business environment is unpredictable or challenging, firms should revise their routines (March 1991). DC leads organisations to rethink their strategies about capabilities and resources (Defee & Fugate; 2010 Pettus et al. 2009; Zahra et al. 2006). While functional capabilities are conceptualised as a firm’s distinctive way of solving problems, DC refers to the ability to change ‘the way the firm solves its problems’ (Zahra et al. 2006 p. 920). DC is not an ‘ad hoc problem solving solution’ or ‘spontaneous fire-fighting activity’; rather, it represents a purposeful and identifiable process (Eisenhardt & Martin 2000), a learnt and reliable pattern of common activities (Zollo & Winter 2002) and a capability to achieve a purpose in an adequate and repetitive manner (Teece et al. 1997). The basic assumption of the DC framework is that:

core competencies should be used to modify short-term competitive positions that can be used to build longer-term competitive advantage. In other words, dynamic capability is the company's skill to integrate, build and reconfigure internal and external competences to promptly react to the changing environment. The literature on dynamic capabilities grew out of the resource-based view of the firm and the concept of 'routines' in evolutionary theories of organization (Teece et al. 1997 p. 516).

Firms that use a resource-based strategy depend on accumulating precious technological resources and applying a disruptive intellectual property viewpoint. However, the best manufacturers in the international marketplace are well known for their time responsiveness, swift and flexible product innovation, and executive efficiency in exploiting external and internal competencies (Teece & Pisano 1994).

As Table 3.1 details, researchers have employed DC theory in both qualitative and quantitative studies. In the research by Wang and Ahmed (2007), they examined 32 empirical studies relating to DC theory between 1995 and 2005. Twenty of the 32 studies built on the qualitative methodology. Further, it appears that, during the last 10 years, DC theory has attracted more conceptual research with a quantitative methodology (Kristal et al. 2010). Table 3.1 highlights the most relevant studies from the literature review that incorporated qualitative methodology and DC theory.

**Table 0.2: Most Relevant DC Studies Related to the Qualitative Method**

Authors	Title of the study and/or focus of the study	Analysed sample
Sako (2004)	Focusing on the factors that facilitate and constrain the sustained development and replication of suppliers' organisational capabilities	Honda, Nissan and Toyota
Keil (2004)	Focusing on the role of learning in developing a capability to create and develop ventures through corporate venture capital, alliances and acquisitions	Two longitudinal case studies in the information and communication technology sector in Europe
Wang and Ahmed (2007)	'Dynamic Capabilities: A Review and Research Agenda'	Conceptual paper: aims to clarify the concept of DC and identify the features of the three main component factors of DC
Parente et al. (2011)	'The Effect of Supply Chain Integration, Modular Production, and Cultural Distance on New Product Development: A Dynamic Capabilities Approach'	Brazilian automobile suppliers sector
Ramirez et al. (2012)	Scenarios and early warnings as DC to frame managerial attention	Case study of Finnish multinational companies
Mohamud and Sarpong (2016)	'Dynamic Capabilities: Towards an Organizing Framework'	Conceptual paper: Framework built around the inter-relationships and hierarchies of capabilities and to extend the understanding of how DC can be developed relative to a firm's ability and embedded context
Koch (2010)	'Developing Dynamic Capabilities in Electronic Marketplaces: A Cross-case Study'	Business-to-business electronic marketplaces in the US
Ellonen et al. (2009)	Linking DC portfolios and innovation outcomes	The publishing industry in Sweden and Finland
Hitchcock (2012)	'A Qualitative Exploration of Experiential Practitioner Dynamics of Enterprise Executive Capability Development and a Comparison to the Educational Objectives and Dynamic Capabilities Frameworks'	Academic and business research

The combination of resources and capabilities represents the core capabilities of an organisation that allow it to outperform the competition (Teece et al. 1997). However, core capabilities can be insignificant or even dissuasive in the case of environmental changes, such as uncertainty in demand, exchange rate fluctuations and industry-based variations (Leonard-Barton 1992). Organisations in these conditions can create a trap for themselves if they do not react quickly to the required changes (Wang & Ahmed 2007; Teece et al.

1997). In these situations, DC is the primary organisational capability that can lead a firm to long-term success (Teece et al. 1997).

This study did not only select the DC theory because of its recent frequent application in business research, but also because this study gained more benefit from applying DC than any other theory because DC theory concentrates on operational strategies that are recommended to be applied in a turbulent market environment. However, DC theory itself does not present a complete practical and theoretical solution because of the two sides of the recent manufacturing situation in Australia. The reason DC theory is unable to serve the theoretical framework alone is the fact that, while organisations try their best to frequently reassess their resources and capabilities and save costs, there is a view and trend that suggests that the only solution to save costs is to move production to low-cost countries (Pezeshkan et al. 2015; Sirmon et al. 2010). For this reason, TCO was selected as the most appropriate tool and theory to calculate the true cost of offshore operations and to complement DC in the theoretical framework of this study.

According to the theory foundation, DC is necessary to implement during the decision to source offshore to ensure an appropriate combination of resources and capabilities. The relevance of DC theory to this research is that, through the study interviews and online surveys, the firms' management strategies have been compared with DC theory on the basis of whether firms can manage a dynamic fit between what the firm offers and what the market dictates. Australian manufacturers have been compared on the basis of whether their offshore or onshore manufacturing activities effectively serve customer demand. After data analysis, the interviews have been explored via a DC theory lens for the interview participants' perspective on their operations and supply chain strategies. Each case have been assessed in terms of whether offshore manufacturing activity is viable for the organisation in a changing environment. In other words, the study has considered whether an offshore strategy in the innovative manufacturing sector offers sufficient agility to achieve long-term competitive advantage. Through targeted interview and survey questions, the responses have evaluated to determine whether the specific manufacturers implement an appropriate level of agility.

Firms should implement a DC perspective in their managerial decisions to reassess their core competencies periodically, review their capabilities and resources, and make prompt strategic changes if necessary. To avoid an unsatisfactory offshore decision, manufacturers should carefully look beyond the price of the product and assess all the indirect, hidden, lifecycle and transaction costs, as well as the acquisition, use and maintenance of the product (Chien & Tsai 2012; Defee & Fugate 2010; Jurksiene and Pundziene 2016; Mohamud & Sarpong 2016; Wu et al. 2013).

Further research into the literature discovered topics on the deficiencies of DC theory. As Sirmon et al. (2010) explained, despite the popularity of DC in the recent literature on innovation research, several shortcomings still exist. For example, the relationship between DC and competitive advantage is inconsistent in several cases (Pezeshkan et al. 2015), as Pezeshkan and his colleagues argue that a competitive advantage cannot be sustainable in so-called 'hypercompetitive' environments. D'Aveni and Ravenscraft (1994) also argued that firms that successfully transform multiple times may not necessarily be able to repeat this transformation in the future. Thus, after considering that DC might be unable to serve alone as the theoretical lens for this study, this study reviewed a broad range of theories in the operational, supply chain and innovation areas. The weaknesses of DC theory and the emerging topic about the sourcing debate raised the idea of implementing TCO into the theoretical framework, as discussed below. A further brief discussion is presented in Chapter 7 about the significance of combining DC and TCO as the main aspects of the theoretical framework.

### **3.4 Background and Relevance of the Total Cost of Ownership**

As mentioned above, despite the relevance of DC theory to this study, it could not serve as the sole basis of the true evaluation of the research question, and could not provide a suitable answer to the research questions. Alongside the arrangement of resources and capabilities, organisations must also cautiously consider the real costs of offshore operations. For this reason, TCO was selected to complement DC.

The TCO concept was originally developed in 1987 by the American Information Technology Research and Advisory firm, Gartner Inc. (Bremen et al. 2007), to evaluate a



sourcing decision by considering all costs associated with the acquisition, use and maintenance of a product. Traditionally, the actual prices of goods were the primary factor when selecting suppliers or deciding to implement offshore manufacturing (Degraeve & Roodhofs 1999). However, firms have become more strategically aware of the importance and relevance of the indirect and hidden costs of international sourcing (Cousins & Spekman 2003). As a result, decision makers have started to venture into examining the numerous indirect and lifecycle costs, besides the certain prices of goods and services from partners overseas. For this purpose, the TCO analysis has received extensive attention as a cost-management tool and effective way to uncover the hidden, indirect costs inherent in offshore operations (Ellram 1993). To extend this view, Weber et al. (2010), Moser (2011) and Zachariassen and Arlbjorn (2011) stated that the TCO calculation is favoured to compare onshore and offshore manufacturing.

Table 3.2 highlights the different costs that should be considered when planning to go offshore. This table indicates the importance of TCO, and how to calculate the real cost of an offshore operation. This table can be accessed as an online TCO calculator, which was invented in the US by the Reshoring Initiative (Moser & Lang 2011), supported by the US Government, for the purpose of examining the real cost of offshore manufacturing. This online calculator raises the emerging question of whether Australian manufacturers consider all 36 (or more) costs (hidden and unexpected) when planning to go offshore.

**Table 0.3: TCO Calculator (Source Moser 2011)**

N	Input data factors	Factors in the US	Common factors worldwide	Explanation
1	Country of origin	Select		Country determines freight rates.
2	Unit price (\$)			For in-house production, insert standard cost or cost of goods sold.
3	Units/year (quantity)			
4	Product category		Select	Product category determines duty rate. The programmed duty rate for parts is 4% and for tools is 8%. If your product's duty rate is different from one of these, still select a product category and insert your duty rate in the cell in the next row.
5	Duty rate, if other than one of the default rates	%		To select a duty rate other than the default values, this number would then override the

				default rates.
6	Unit weight (lbs)			
7	Unit weight, packaging (lbs)			Offshored will typically weigh more. Export packaging is more complex and must meet standards of destination and origin countries. Must deal with longer and more varied conditions.
8	Shipments/year			
9	Shipment planned for surface freight (%)	%		The balance for offshored is assumed to be air freighted.
10	Product life (years)			Time until product is obsolete or significantly revised.
11	Supplier relationship life (years)			Estimated time from first purchase until last purchase.
12	Packaging (% of price)	%		Offshored will typically cost more. Export packaging is more complex and must meet standards of destination and origin countries.
13	Lag from shipment date until actual payment date (months)			Asian suppliers are often paid prior to shipment.
14	Shipment time (months)			
15	Annual carrying cost, in transit (% of price)		%	Probably cost of capital. Only enter a value if the product is paid for prior to shipment.
16	Annual carrying cost, in warehouse (% of price)		%	Most articles suggest 25%.
17	% of shipments that can be delivered directly to the floor JIT	%		Typically, offshored shipments are larger and must be locally warehoused.
18	Cost to place and pick in local warehouse (% of US price)		%	Locally warehoused products must be placed and picked before delivery to the factory floor.
19	Delivery time from order to receipt (months)			Offshored is typically longer because of shipping time and less frequent shipments.
20	Quality, rework, warranty (% of price)	%		Warranty costs are probably recorded as a per cent of sales price, not of parts price.
21	Product air freighted to meet unforecast demand or overcome quality/delivery issues (% of product shipped)	%		
22	Opportunity cost because of delivery and quality: lost orders, slow response, lost customers (% of price)	%		Opportunity cost despite emergency air freight. These costs are perhaps kept as a per cent of sales price.
23	Unrecoverable product	%		Extremely difficult to collect from Chinese

	liability (expected % of price)			vendors.
24	Intellectual property risk (expected % of price)	%		Trade in counterfeit and pirated goods equals \$800B/year, 5–7% of world trade, per International AntiCounterfeiting Coalition. 80% of counterfeiting comes from China.
25	Supplier economic instability risk (% of price)	%		
26	Country political instability risk (% of price)	%		
27	Innovation loss (expected % of price)	%		‘co-location synergies ... are more pronounced the more R&D intensive the supply chain’; ‘much of the knowledge underlying emerging technologies is tacit in nature ... co-location synergies are critical.’
28	Trips to the supplier/year			Audits, partnering, negotiations, etc.
29	Cost/trip: travel (\$)			For example, for two weeks in China: airfares = \$1,500, 13 nights hotel = \$200, 13 days of meals and miscellaneous = \$100.
30	Cost/trip: time, including fringes (\$)			For example for two weeks in China, weekly: salary = \$1,500 and fringes = \$500.
31	Pre-evaluation, regulatory compliance cost, 1X (\$)			Time and expense to visit several suppliers and then audit one or more to select one.
32	Purchasing cost, other than travel (% of price)	%		
33	Prototype cost			Prototypes typically sourced locally to facilitate partnering. Prototype cost will be higher if production will be offshored, since US shop will charge more if it does not receive production.
34	Effect on product differentiation/mass customisation (% of price)	%		Long pipeline and loss of clustering effect causes fast reaction to be more difficult, thereby driving the company towards commoditisation.
35	Wage inflation, forecast, annual (%)	%		
36	Currency appreciation versus \$, forecast, annual (%)	%		

The main selection criteria of Table 3.2 are the ‘input data factors’, which list the most common unexpected, hidden, visible and lifecycle costs that can occur in offshore production. The ‘US’ column indicates that organisations in the US should input their specific data in this column, while the ‘common’ column indicates that these criteria apply for every other country. The ‘explanation’ column provides a detailed explanation of the

‘input data factor’, thereby helping determine the true impact factor. The percentage symbol ‘%’ under ‘US’ indicates that organisations need to insert their input factor in percentage.

Traditionally, the price of goods was the primary factor when selecting suppliers or deciding on outsourcing (Zachariassen & Arlbjorn 2011). However, firms have become more strategically aware of the importance and relevance of indirect and hidden costs in international sourcing (Defee & Fugate 2010). Calculating and considering the data factors included in the above table can help achieve a better and less biased view of onshore and offshore manufacturing. Manufacturers in general—and especially in the innovative sector—should carefully consider these factors before going offshore. Table 3.3 summaries recent studies in supply chain management area where total cost of ownership analysis was incorporated.

**Table 0.3: Most Relevant TCO Studies in Supply Chain Management area**

<b>Author/year</b>	<b>Title</b>	<b>Findings</b>
Fel & Griette 2017	Near-reshoring your supplies from China: a good deal for financial motives too	Near-reshoring is a recent but growing phenomenon: almost half of the companies sourcing in China chose over the past few years to near-reshore the supply of certain products initially purchased in China, and 10 per cent plan to do so soon. The authors determine main motives for near-reshoring and show that companies having reshored are very satisfied
Zachariassen, & Arlbjørn 2011	Exploring a differentiated approach to total cost of ownership	This paper indicates that a differentiated approach to TCO might be necessary, as suppliers might react negatively to the focal company presenting TCO data in negotiations. A matrix is proposed involving two dimensions: the nature of the relationship and the complexity of cost drivers.
Kumar et al. 2014	Supplier management in a manufacturing environment: A strategically focussed performance scorecard	sourcing managers should realize the potential for aligning and managing their supplier base with the strategy of the company to assure a profitable future.
Palmera et al. 2018	Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan	Market share of hybrids is strongly correlated with their relative TCO.
Kumar et al 2011	A global supplier selection process for food packaging	The results of this study show a standardized supplier selection process and the total cost of ownership model for a CPF manufacturer which incorporates the different logistic costssuch as tariffs, duties, inventory carrying levels

		and cost of quality.
Liebethruth 2017	Sustainability in Performance Measurement and Management Systems for Supply Chain	Aspects of sustainability – understood as the ability to manage economic, social and environmental performance at the same time – are becoming more important in Supply Chain Management.
Visani et al. 2016	Supplier's total cost of ownership evaluation: a data envelopment analysis approach	The results show that TCO-based DEA is able to significantly approximate the outcomes of TCO, for both the efficiency indexes and rankings of suppliers, whilst requiring substantially less effort to perform the analysis.
Hartman et al. 2017	Nearshoring, reshoring, and insourcing: Moving beyond the total cost of ownership conversation	The findings from this case study suggest that the current manufacturing relocation shift is not perceived by manufacturers as a long-term business strategy (as outsourcing has been). As such, the results suggest that manufacturing relocation decisions based exclusively on models such as total cost of ownership (TCO) will not deliver anticipated near-term costs savings.
Settanni et al. 2017	Pharmaceutical supply chain models: A synthesis from a systems view of operations research	this research provides initial directions towards an integrated systems approach to PSC modelling. This perspective involves problem conceptualisation and boundary definition; design, formulation and solution of mathematical models, through to practical implementation of identified solutions.

The relevance of TCO analysis when considering offshore manufacturing is that it indicates the importance of looking beyond the price and considers the acquisition, use and maintenance of a product; studies the true cost and cost drivers to assign the indirect costs of onshore operations; and helps firms become aware of the indirect, hidden and lifecycle costs in international sourcing. Thus, applying TCO to purchasing, outsourcing or offshoring decisions can give organisations the possibility to exploit TCO in value analysis (Degraeve et al. 2005; Degraeve & Roodhooft 1999; Ellram 1995; Ellram & Maltz 1995; Ellram and Siferd 1993; Garfamy 2006; Hartman et al. 2017; Moser 2011; Saccani et al. 2017; Weber et al. 2010; Zachariassen & Arlbjorn 2011).

The importance of Moser (2011) and the Reshoring Initiative to this research is that TCO analysis will be conducted to study the true cost and cost drivers to assign the indirect costs of onshore operations, as the 36 different elements in the TCO calculator are the cost drivers of an operation, especially when organisations are considering going offshore. By using the TCO estimator and incorporating all 36 factors into their calculation, Australian manufacturers would be able to evaluate the real cost of an offshore operation. The TCO calculator provides complete understanding for manufacturers about the possible costs of

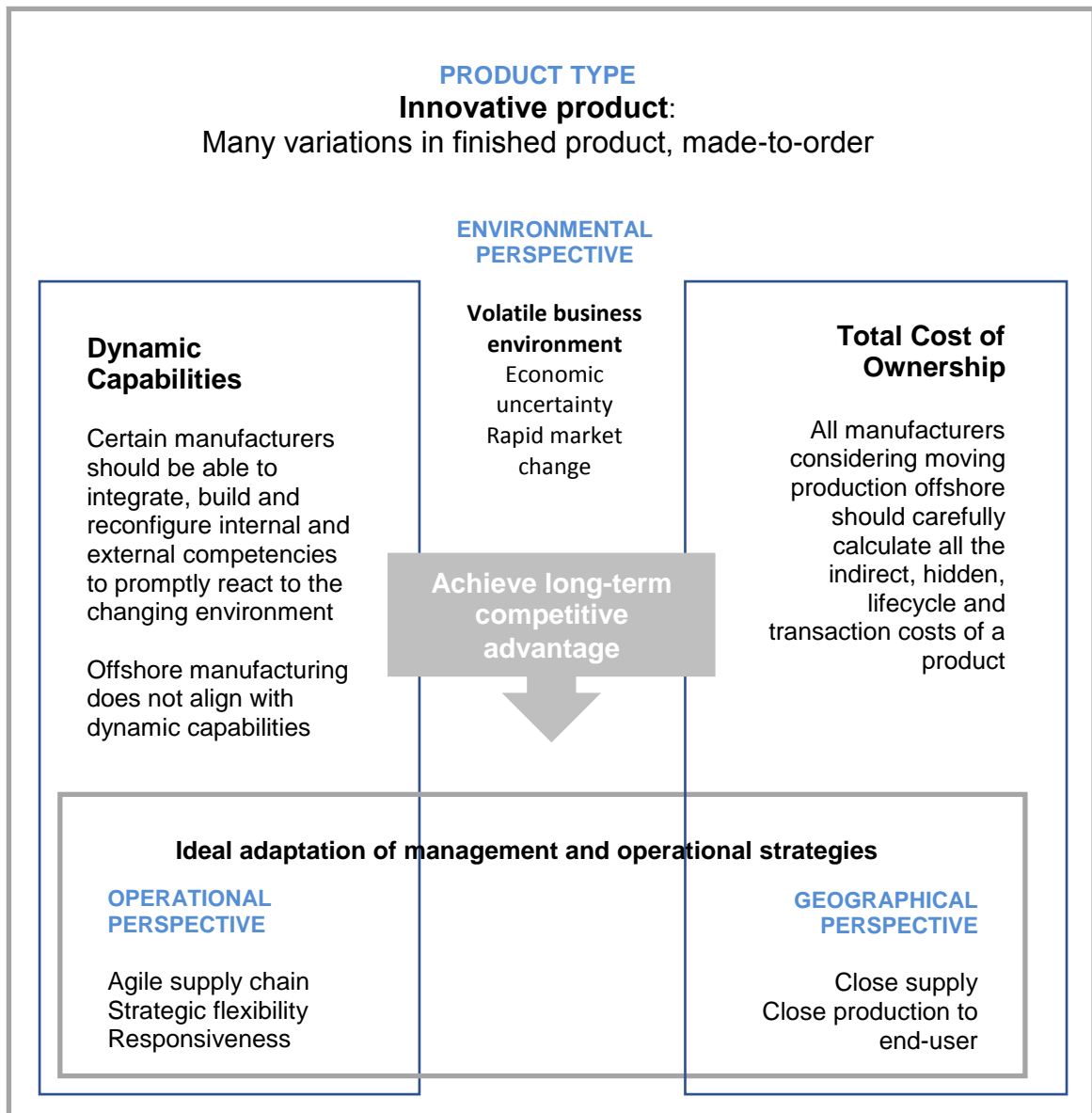
preparing an offshore production, and can be also applied to compare onshore and offshore operations. Further, in terms of the theoretical framework, this study suggests applying TCO calculation before deciding to go offshore.

However, according to Hagman et al. (2016), TCO does not necessarily provide insight into the timing of the cost. Another disadvantage is that organisations only use TCO to minimise costs; however, they should consider how to maximise benefits—rather than choosing the cheapest solution, they should choose the application that provides the greatest benefit (NR, 2002). Further, TCO is very likely to reduce long-term costs; however, it also adds expense because of the need to gather more information, which increases workforce costs. Moreover, capturing the benefits of TCO analysis in a single year's budget can be difficult (FEC 2006).

In consideration of the benefits, limitations and practical application of DC and TCO, this study applied both theories to investigate and answer the research question. In terms of the theoretical framework of this study, the above theories were applied to assess the appropriate combination of resources and capabilities, as well as to assess all the indirect, hidden, lifecycle and transaction costs of a product as part of the supply chain.

### **3.5 Theoretical Framework**

A detailed literature review on the topic of supply chain agility and offshore/onshore manufacturing showed a lack of strong experimental basis, which may not provide a complete understanding of this complex phenomenon. By combining the above two theories, this study potentially offers a fresh view to study onshore manufacturing with an agile supply chain. These theories alone have limited explanatory power; however, combining these theories has the potential to develop a more complete understanding of the research problem. Figure 3.1 demonstrates the theoretical framework that combines both theories. The assumption of this study is that offshore operations may be a good decision to react to a changing environment; however, this decision may not be optimal in the long term. Managing a company remotely or managing a company in a different social and political environment can cause many unpredictable events (Stanczyk et al. 2017).



**Figure 0.7: Theoretical Framework**

The theoretical framework in Figure 3.1 shows a different perspective of an operation. In terms of ‘product type’, this study focused on innovative product manufacturers. The ‘environmental perspective’ highlights that businesses currently work in a volatile business environment. The ‘theoretical perspective’, including the two selected theories of DC (which suggests that companies should frequently integrate, build and reconfigure internal and external competences to promptly react to the changing environment) and TCO (which proposes that organisations should wisely calculate all the indirect, hidden, lifecycle and

transaction costs of a product when considering moving production offshore). The third important aspect of the theoretical framework is the ‘operational perspective’, which recommends applying an agile supply chain, strategic flexibility and a high level of responsiveness for manufacturers with innovative products. The fourth important perspective is the ‘geographical perspective’, which recommends proximity to the market to enable reactions to customer requirements and the changing business environment. In this study focusing on the manufacturing sector in Australia, the proposed theoretical framework will be used to guide the data collection and analysis of the study to meet the objective of the study.

The opposing option of offshore manufacturing does not appear to fit the DC theory (Parente et al. 2011) in a geographically and culturally distant situation, especially when supply chains involve operations in different continents. For example, when offshore manufacturers have to change a product, redesign a product, change a management strategy, develop innovation or sustain change, long term offshore operations can create difficulties for operations to react to a changing environment (Radjou 2000). Further, capacity constraints and the inability to successfully respond to consumer requirements make global manufacturing inflexible (Cagliano et al. 2012; Holweg et al. 2011; Platt & Song 2010; Stanczyk et al. 2017; Vos et al. 2016).

International sourcing and offshore manufacturing can result in larger investments because of long transportation, which can generate several hidden costs, as well as difficulties in remotely managing outsourced manufacturing (Hannon 2009, Holweg et al. 2011). According to Christopher and Holweg (2011), organisations that have an agile supply chain—including a local sourcing strategy combined with lean and agile principles—in their operations are able to respond more rapidly to the ever-fluctuating customer demand and increasingly turbulent market, compared with firms who use global sourcing (Kisperska-Moron & de Haan 2010; Naim & Gosling 2011).

Many companies believe that sourcing goods from low-labour-cost countries—such as China, India, Malaysia and Indonesia—is still viable; however, they overestimate the savings and do not realise the negative effects, such as dealing with exchange rates, obsolescence, inventory and many other dynamic and hidden costs (Kotabe and Murray,



2004, Butner, 2010). When competitive advantage derives from speed and a track record of reliability, offshore manufacturing is often not a suitable strategy. According to several authors (Oshri et al. 2009; Perry 2012; Platt & Song 2010; Tunisini et al. 2011; Stanczyk et al. 2017; Vos et al. 2016), speed has become a competitive weapon, and can create a trap if a supply chain becomes complex and slow.

### **3.6 Summary of Theoretical Framework**

In recent supply chain trends, markets are increasingly interconnected, outsourcing or offshoring are more common, and companies are concentrating mostly on their main competencies (Liu et al. 2010). Expanded supply chains could provide companies with operational effectiveness, which can lead those organisations to achieve high performance and competitiveness. Nevertheless, emerging risk can reduce the benefits of global businesses, weaken a company's reputation and damage competitiveness (Liu et al. 2010).

There are many possible ways for organisations to can gain competitiveness; however, in a turbulent market environment, strategic flexibility is required. The direction of a firm's expansion may be unclear; thus, firms need to implement agility in terms of renewing existing resources, changing their resource position and refreshing their capabilities to be able to adapt to changing customer demand (Smith & Grimm 1987). Strategic flexibility requires organisational routines to reconfigure a firm's resources to respond to specific environmental changes (Zollo & Winter 2002). By maximising the productivity of a certain set of new resources, firms will learn and gain achievement from the contribution of new resources. Meanwhile, TCO calculation will assist organisations to evaluate the real cost of offshore operations.

This study focuses on frequent innovators; thus, a question emerged regarding what is the optimal solution for innovative manufacturers to achieve long-term competitive advantage in a volatile business environment. The above theoretical framework summarises all the related areas examined in this study, such as business environment, type of product, theories involved, type of managerial strategies, and geographical distance between manufacturing site and end-user. According to the theoretical framework, these factors together determine sustainable competitive advantage in a successful supply chain. As

demonstrated by Figure 7.1 in Chapter 7, the theoretical framework helped examine the study data by providing a thematic order to analyse the data, and offering a specific connection to the different themes established in the data and to the research questions. The theoretical framework contributes to classifying the different categories in the themes.

## **Chapter 4: Methodology**

### **4.1 Introduction**

From a research perspective, the review of the literature led to the emergence of one main question and two sub-questions, which provided the theoretical motivation for this research. The main question considered—in contrast to the trend for Australian manufacturers to move production to low-cost countries—how agile supply chain management can add value for Australian manufacturers to create innovative products closer to the end-user. This led to the research sub questions, as ‘What is the trend among Australian manufacturers regarding local sourcing and local manufacturing strategies’; and ‘What is the view of Australian manufacturers in regard to the effect of lean, agile and flexible supply chain strategies on their operations?’ Reviewing the sub questions also raises an emerging question about close manufacturing and the correlation between product type and geographical distance in terms of the whole supply chain. Supply chain management and operation research uses both qualitative and quantitative research methods; however, this study selected the qualitative method because this is the most suitable method to research areas in which the issues under study have a high degree of uncertainty, have not previously been studied, or have had only a few studies undertaken previously (Benbasat et al. 1987; Trauth 2001; Walsham 1995; Yin 2003). Table 4.1 outlines the research concept applied in this research project, including the research method.

**Table 0.4: Research Concept**

Research concept	Category	Reason/description	References
Research classification	Qualitative research	The data used to understand the decision-making process of evaluating strategies of value delivery were primarily sourced from interview data	Creswell (2017), Salkind (2010)
Philosophical stance	Exploratory, interpretive	Logically link abstract ideas to precise measurements of the social world	Neuman (2006), Wahyuni (2012)
Qualitative research method	Case study, Single case study	Investigate a representative phenomenon in its real-life context, collect data in a single context but having multiple units of analysis	Yin (2003), Richards and Morse (2013)
Phenomenon studied		Explore agile supply chains for creating innovative products closer to the end-user	
Research approach	Sequential exploratory strategy, inclusion of preliminary interviews and secondary online survey data collection	Conduct interviews: when investigator has enough knowledge to develop a question about the certain case, but not enough to anticipate the answer, semi-structured interviews are the best method to choose	Richards and Morse (2013), Creswell (2009)
		Conduct online survey for validation of interview results	Canvana and Delahaye (2001), Wetcher-Hendricks (2011)
Modes of analysis	NVivo analysis of interviews	Analyse data with NVivo, with the assistance of thematic coding	Gibbs (2007), Coffey and Atkinson (1996), Boyatzis (1998)
	Statistical analysis of survey questionnaires	As qualitative analysis was the preliminary research method in this study, survey questionnaires were analysed with a basic statistical model	Creswell (2009)

Qualitative research was chosen for this study after considering the research situation and the need for theory building. Further, to validate the results of the qualitative data, an online survey was conducted. This research was predominately qualitative research with a small quantitative element supporting the qualitative work.

This chapter outlines the possible selection of research strategies and the chosen approach. Section 4.2 provides information about the choices underlying the research philosophy, such as the main aspects of the research philosophies and paradigms. Section 4.3 describes the research classification and methodological approach; section 4.4 outlines the case study approach, while Section 4.5 summarises the thematic coding. Section 4.6 highlights the

research design; section 4.7 summarises the Hermeneutic Cycle, while Section 4.8 provides detailed information about data collection. Section 4.9 gives a brief overview about how data was transformed. Section 4.10 discusses the data analysis by Nvivo, while Section 4.11 discusses how online survey was conducted. Section 4.12 outlines the ethical consideration while 4.13 describes the research rigour and finally section 4.14 summarize the research method

## **4.2 Choices for the Underlying Research Philosophy**

Previous studies on onshore manufacturing/local sourcing have adopted different approaches; however, they have commonly applied an interpretivism research strategy with a qualitative approach to investigate written data and their correlation with the emerged questions (Cagliano et al. 2012; Holweg et al. 2011; Ellram et al. 2013; Kazmer 2014;). In this particular study, qualitative research was chosen after considering the research situation and need for theory building. This research applied an exploratory, interpretive view of supply chain operations, with a single case study approach, alongside investigation of semi-structured interviews which has been validated with survey study.

To justify the various theoretical assumptions and basic beliefs, there are four main research paradigms: positivism (naïve realism), post-positivism (critical realism), interpretivism (constructivism) and pragmatism. To choose between the four kinds of paradigms, the easiest approach is to look beyond the connection between the fundamental beliefs (ontology, epistemology, axiology and research method) and the research paradigms (Wahyuni, 2012).

The interpretive position is often used as an alternative to positivism. This approach is based on the strategy that, to study social reality, researchers need to consider the differences between people and objects of the natural sciences and to understand social action. They should apply techniques that examine social context and how to achieve an understanding of the social world, rather than testing theories of human behaviour, as stated by Orlikowski and Baroundi (1991), Neuman (2006) and Wahyuni (2012).

### **4.3 Research Classification and Methodological Approach**

After selecting the role of theory and the underlining philosophy for this study, the next step was to establish a style or strategy for the research project. The style or strategy can often be classified as either quantitative or qualitative (Bryman 2004). Qualitative research, or qualitative enquiry, is an umbrella term summarising different research methods and methodologies that maintain holistic, in-depth features and views to reflect the sophisticated, interactive, contextual and interpretive nature of our social world (Creswell 2017). In qualitative design, researchers regularly implement inductive approaches to encourage knowledge development (Neuman 2006). Qualitative projects are mainly value driven and attentive, as they express social justice or social change (Staller, cited in Salkind 2010).

Creswell (2009) explained the weighing process of the methodological approach, as it is one of the main factors involved in determining the weight of priority given to quantitative or qualitative research in a particular study. In some studies, the weight of qualitative and quantitative approach might be equal, while others might emphasise one over the other. Priority for one type depends on the interests of the researcher, the audience of the study and which factors the researcher seeks to emphasise in the study.

Sequential exploratory strategy was the most suitable approach for this study because this involves a first phase of qualitative data collection and analysis, followed by a second phase of quantitative data collection and analysis that builds on the results of the first qualitative phase (Creswell 2009). Weight is generally placed on the first phase, and the data are mixed through being connected to the qualitative data analysis and data collection. The design may or may not be implemented within an explicit theoretical perspective. Quantitative data in this approach assisted the interpretation of the qualitative findings, and were mainly used to explain a phenomenon (Creswell 2009). Therefore, in this study, the qualitative approach was the preliminary and most important part of the study, and the results were validated by an online survey with a closed-ended questionnaire. Qualitative research designs are mostly in contrast to quantitative designs, as their features are fixed and formerly planned. Quantitative research largely uses statistical or mathematical

analysis techniques because these techniques are consistent with positivist approaches to research (Newman and Benz 1998). Positivism is based on the scientific method, which requires measurement (Wetcher-Hendricks 2011). Moreover, the scientific method comprises empirical and theoretical support for the examination of populations and samples (Salkind 2010).

As described by Richards and Morse (2013), when the investigator has sufficient knowledge to develop questions about a certain case, yet not enough knowledge to anticipate the answer, semi-structured interviews are the best method to choose. The researcher should first design open-ended questions in an appropriate order to cover the required field of study. It is suggested by Richards and Morse that the researcher should ask the same questions from all participants, with the assistance of an audio recorder, and with the interviews transcribed to prepare for analysis. These types of interviews are comfortably pre-planned questions that can be reliably asked to all participants (Richards & Morse 2013).

After transcribing and analysing the interview data, it is then necessary to implement data analysis. Considering the best method to confirm the interview results, the literature and other research suggest verifying these data with a survey (Creswell 2009, 2017). The advantage of confirming interview results with a survey derives from the differences between these two methods. Interviews offer the possibility to ask semi-structured, open-ended questions, which provides a reliable tool for exploring the phenomenon. Surveys elaborate with closed-ended questions, with the possibility of targeting specific topics and analysing data with a simple statistical approach or sophisticated computer program. Thus, online surveys provided a tool to establish targeted questions, focusing on the main themes to confirm the interview results and focusing on new topics that emerged from the interview results.

#### **4.4 Case Study Approach**

After establishing the philosophical stance and research method, the research approach needed to be selected. Qualitative research methods give the researcher the opportunity to gain close access to the context of the phenomenon, as well as first-hand experience of how

decisions are made (Yin 2003). The two most suitable qualitative tools considered for this research were case studies and interviews. From these two research pathways, the case study approach combined with semi-structured in-depth interviews seemed the most appropriate investigation for this study. As it was mentioned before, semi-structured, open-ended questions in interviews offer the possibility to thoroughly explore the phenomenon under study.

A common perception among researchers is that case studies are only sufficient for exploratory research, surveys and histories are suitable for descriptive studies, and experiments are only appropriate for explanatory or casual investigations (Shavelson & Townes 2002). Meanwhile, case studies have been criticised by several researchers (Baxter and Jack 2008; Stake 1995) for their lack of research rigour, lack of clarity, bias, lack of systematic strategy and unclear evidence, all of which distort the study findings (Yin 2003). Another frequent concern about case studies is that they cannot form the foundation for generalisation, especially with the approach of a single case study. However, as Yin (2003) stated, despite their disadvantages, extensive numbers of case studies have been conducted with recognised and celebrated results.

According to Yin (2003 p. 14), a case study 'is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident'. The case study approach covers the logic of design, data collection techniques and defined pathway of data analysis; thus, it is a comprehensive research strategy (Canvana & Delahaye 2001; Corbin & Strauss 2008; Creswell 2009; Creswell 2017; Neuman 2013; Strauss & Corbin 1998). The most important difference between case studies and other methods is that case studies can better explain the links between complex real-life events than can any survey or experimental strategy (Stake 1995). Therefore, as this research is addressing the question 'how', an in-depth case study provides the best answer rather than a survey (Yin 2003).

Although case study research has been mostly adopted in psychology, sociology and the political sciences (Gilgun 1994), increasing numbers of case studies have been implemented in business and economics-related research (Baxter & Jack 2008; Cavaye 1996; Creswell 2017; Eisenhardt 1989; Yin 2003). In these situations, the structure of the



exact industry or economy of a region is generally under investigation. However, researchers mainly apply cross-case study (multiple case study) design in situations when more cases are under investigation. In the current research, it can be declared that the 'case' is the manufacturing sector inherent within the trend related to moving offshore. As a result, the data collection and analysis was built on the single case study methodology.

This study is a single case study with multiple units of analysis. As Yin (2003) reported, a single case design can be best described as collecting data as a single case context with a single unit of analysis, or in a single context but having multiple units of analysis. This study is a 'representative case', where the objective is to capture the circumstances and conditions of an everyday or commonplace situation. A case study represents a 'typical project' among many different projects (Yin 2003). For instance, a manufacturing firm believed to be typical of many other manufacturing firms in the industry.

The unit of analysis refers to the precise objective of the research, the major entity that is being analyzed in a study (Creswell 2007); the entity about which one is trying to draw conclusions. It is the 'what' or 'who' that is being studied. In this study, the unit of analysis was the Australian Manufacturing sector, looking at multiple participants within the case (e.g. different organisations with manufacturing activities) with representatives from each organisation.

## **4.5 Thematic Coding**

It can be difficult to analyse case study evidence because of the lack of strategies and techniques to do so (Alvesson & Kärreman 2011). Hence, it is important to be familiar with different techniques and analytical tools. Every case study investigator must prepare a general analytic strategy, specifying the preferences for what to analyse and how (Alvesson & Kärreman 2011). With or without considering the choice of analysis strategies, the main concern of a researcher is to produce high-quality analyses (Rubin & Rubin 2012; Wengraf 2001; Creswell 2017). Coding systems should be chosen depending on which method is selected, as well as the researcher analysing the unstructured text to build on the approach selected (Richards & Morse 2013).

As a qualitative method, researchers apply thematic coding as a tool under thematic analysis, which is a process usually used to encode qualitative information (Boyatzis 1998). The 'encoding' process requires an explicit 'code', such as themes or a complex model with themes and indicators. A theme is a pattern found in the information that explains the observation and interprets the variables of the phenomenon (Coffey & Atkinson 1996, Miles & Huberman 1986). There are three steps in developing themes and codes: (i) developing sample themes, (ii) developing themes and codes and (iii) validating and using the code. There are three main types of coding under thematic analysis: data-driven, theory-driven and prior-research code. This study applied the data-driven code approach. Data-driven codes are constructed inductively from raw data. They emerge with the words from interviews and surveys, and create patterns from the raw information (Boyatzis 1998).

To analyse the data of this particular study, after considering the method from Gibbs (2007), thematic coding was chosen. Although there are many different methods of coding, the final purpose of these activities is to simplify and focus on some specific characteristics of the data and achieve a final structured conclusion from the unstructured and messy data. Coding is a method of indexing or categorising text to establish a thematic idea of the data (Gibbs 2007). As aforementioned, in terms of accomplishing a comprehensive data analysis result, an overall analytic strategy is required. In this particular study, a computer-assisted analytical tool, the NVivo program, was used to accomplish thematic coding. The advantage of this kind of software is that it can easily find and analyse the frequent patterns of word usage in text (Strauss & Corbin 1998).

Once the data were transcribed, the text was imported to the NVivo program, and the researchers commenced establishing the themes and concepts that were repeatedly found in the data. After the different categories were defined as concepts, themes and sub-nodes, they were reviewed and the researchers referred back to the original transcripts to ensure that the themes were grounded in the data. The hierarchy chart in Figure 4.4 illustrates the different levels of coding. Coding hierarchy was employed to seek more conceptual meanings and themes.

After establishing a code hierarchy, this hierarchy exposed the emergent themes in different levels in the data. Once a specific theme emerged in a particular dataset, other datasets were

reviewed again to see if the same theme could be found. This approach helped ensure that all data were coded similarly. Figure 4.5 illustrates the process. To ensure that all the responses were consistent, triangulation was possible, as all data types were analysed with similar codes. Ensuring validity in research is essential. According to Golafshani (2003 p. 604), validity in the qualitative paradigm is ‘conceptualized as trustworthiness, rigor and quality’. Using multiple methods of data collection increased the validity of research. Moreover, this study established trustworthiness through the use of multiple methods.

## **4.6 Research Design**

Table 4.2 presents the different stages of the research design. As shown in this table, after a deep investigation of the literature, the main research question and its sub-questions were established (Section 1.3). In the next step, the research paradigm was justified, with the classification of exploratory research (Section 4.3). Further, the interview protocol, interview process and ethic approval were finalised. The data collection phase included two stages. First, interviews were conducted with semi-structured questions. After the interviews, the recorded conversations were transcribed into a Microsoft Word document. Data were analysed with the assistance of the NVivo program, which enabled recognition of patterns and the establishment of clear themes in the data. The qualitative data results were then summarised. Second, survey questionnaires were sent out as part of the research design to validate the interview results. After identifying the main themes in Phase 1, survey questions were established and presented in a questionnaire. Most of the questions were created with a Likert-type scale, where the factors were established on a scale of 1 to 5. After analysing the survey results and comparing the findings of both data collections, the data were interpreted, with consideration of the research credibility and transferability.

**Table 0.2: Research Design**

<b>Research design</b>			
<b>Timeline</b>	<b>Method</b>	<b>Study phase</b>	<b>Study approach</b>
Preliminary stage	<b>Literature Review</b> Chapter 2	Determine research question	Literature review about recent supply chain theories & strategies Check government sites and published statistical data about onshore and offshore trends among Australian manufacturers
	<b>Theoretical Framework</b> Chapter 3	Search for suitable theories Establish theoretical framework	Review and summarise academic publications in the specific field
	<b>Methodology</b> Chapter 4	Justification of research paradigm Research design (Methodology Sections 4.2–4.6)	State the research strategy State the type of the design Design the research Design the interview protocol Process prior to interviews Ethics approval Methods for verification
Phase I	<b>Qualitative Data Collection Interviews</b> Chapter 5	Exploratory interviews with semi-structured interview questions State the qualitative approach Identify the qualitative sample	Conduct semi-structured interviews with 12 to 15 onshore and offshore manufacturers Determine interview questions
	<b>Qualitative Data Analysis</b> Chapter 5	Obtain permissions for interview (Methodology Sections 4.7–4.9)	Transcribe interviews from recorded data to Word document Analyse data with assistance of NVivo program Analysis process and methods Data interpretation
Phase II	<b>Quantitative Data Collection Online Survey</b> Chapter 6	Conduct survey with 100 to 150 onshore and offshore manufacturers Determine survey questions and state the approach Identify the sample Obtain permissions for questionnaire State the data analysis (Methodology Section 4.10)	Conduct online survey with Qualtrics program Analyse questionnaire results with basic statistical analysis to confirm interview data result Analysis process and methods Data interpretation
Phase III	<b>Data Analysis Interpreting Results</b> Chapters 7 and 8 Both interviews' and questionnaires' results	Summarise and interpret interview and online survey results Establish research credibility and transferability (Methodology Sections 4.11–4.13)	Interpret research outcomes Determine outcomes of the study and their relation to literature and theory

As suggested by Richards and Morse (2013), the same questions should ideally be asked of all participants; however, in the current study, not all participants were familiar with supply chain management terms and activities. Thus, some interview questions were slightly modified or skipped where necessary. Considering the assumption that the data analysis of a qualitative method can be biased or miss essential information, a decision was made to validate the interview results with surveys. The surveys were analysed with a basic statistical analysis. In the first part of the data analysis, ideas and themes were identified, and then those themes were measured on a Likert scale ranking the importance of the factors from 1 to 5. In the fourth stage of the study, the interview and survey results were summarised and interpreted to attain the study outcome.

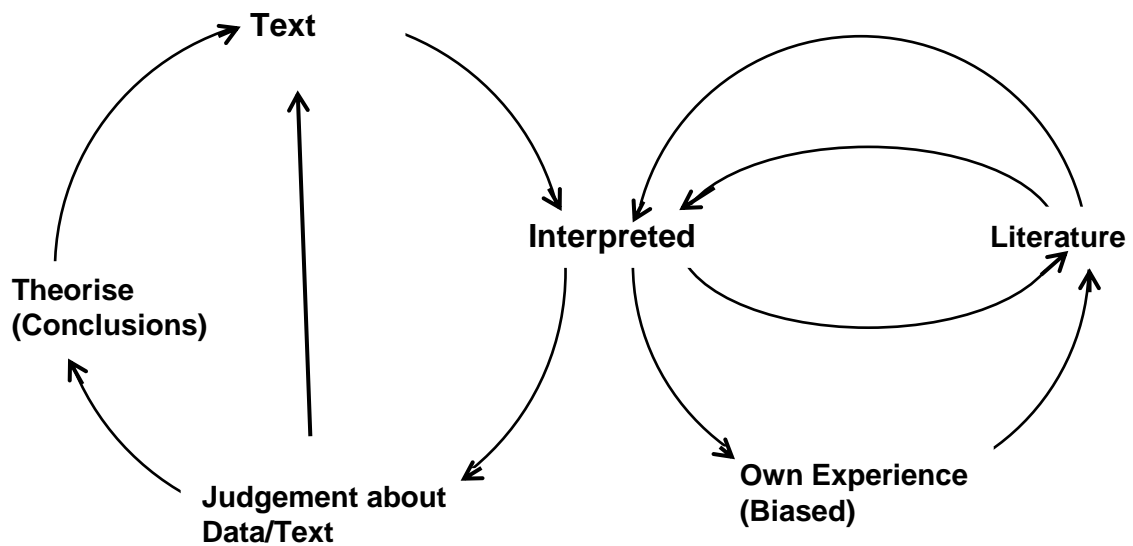
#### **4.7 The Hermeneutic Cycle**

After developing the research design, this study applied the qualitative research approach with narrative form data collection. According to Kvale (1996 p.274), ‘a narrative contains a temporal sequence, a patterning of happenings’. Further, ‘the story is reconstructed with regards to the main points the researcher wants to communicate ... Narrative provides a powerful access to the temporal dimensions of human existence’ (Kvale 1996 p.274). This study also applied a systematic structure to review the literature, thereby building the theoretical framework with the inclusion of the ideological preconceptions of the researcher, with the purpose of applying it during the data analysis process. This technique is called the hermeneutic cycle, which includes reviewing the literature and referencing all statements with multiple citations, as well as providing comments on the data to confirm the researcher’s judgements. Hermeneutics is primarily concerned with the meaning of text. As stated by Myers (1997), Klein and Myers (1999) and Peszynski (2005 p.63), hermeneutics also refers to the basic question of determining the meaning of the text.

The hermeneutic cycle was established by Gadamer (1976), who described the technique to help researchers understand text as a whole, as well as interpreting its parts. The interpretation of text is based on the researcher’s perceptions, the existing literature and the outcome of the research. According to Peszynski (2005 p.63), ‘These interpretations are used to make judgements about the text, creating further reiterations and interpretations of

that text until conclusions or theorising suggest further reinterpretation'. Figure 4.1 illustrates the hermeneutic cycle, which influenced the outcome of this research because it involved reassessing, examining and interpreting the text multiple times from different angles. This technique improved the reliability of the outcomes because the interpretation of the text was influenced by the literature review and the established theory.

### The Hermeneutic Cycle



**Figure 4.8: Hermeneutic Cycle (Adapted from Klein & Myers 1999; Myers 1997; Peszynski 2005)**

Incorporating the method of the hermeneutic cycle to this research enabled the research to be more rigorous because it helped reassess and examine the literature, theoretical framework and findings multiple times to achieve a thorough and objective description of the topic. The different themes established through the data analysis process emerged naturally from the patterns or repetitions in the text, and were linked with the existing literature discussed in Chapter 2 and theoretical framework of Chapter 3. Those chapters were reviewed and modified multiple times to finally obtain an objective outcome from the data analysis. The next section describes the themes and coding establishment in the data.

## **4.8 Data Collection Process, Phase I**

During the first phase, the interviews were conducted, analysed and interpreted. The following subsections present the detailed process of establishing the interview questions, implementing the recruitment method and undertaking the data collection.

### **4.8.1 Establishing the Interview Questions**

According to Yin (2003) and Creswell (2017), the advantage of an interview is that they are targeted and focus directly on the topic of the case study, as well as being insightful; thus, they provide perceived causal inferences with interviewees and the conversation is a guided, fluid discussion, rather than a structured, rigid communication (Rubin and Rubin, 2012). In an interview, the interviewer has two tasks: (i) follow the case study protocol that has been constructed and satisfy the requirements of the line of enquiry and (ii) present friendly and harmless questions without being biased. Most frequently, the questions are open-ended in nature, which can offer a useful tool to receive facts and opinions from the respondents (Yin 2003). However, asking the right questions and executing a successful interview is not always easy (Stake 1995). The biggest difficulty in interviewing is to not receive a simple ‘yes’ or ‘no’ answer, but to obtain an illustration of an episode, a correlation or a justification about a specific case. Designing useful questions and ensuring interviewees have the chance to offer useful responses is inherent to completing a successful interview (Stake 1995).

In the current study, the following four categories of questions were used for each interview:

1. questions about demographical data, such as industry, employee numbers and geographical location of the manufacturing site
2. questions about production; management strategy; supply chain strategy; product type; and export and import proportions of materials, parts or finished products
3. own experience of offshore manufacturing (if relevant), advantages and disadvantages of offshore manufacturing, benefits of local production, advantages

of different supply chain strategies, and advantages of agility and agile supply chain activity

4. overall opinion about offshore manufacturing.

The interview questions were designed to obtain responses to the research questions (Stake 1995). Open-ended questions were asked about companies' operational and supply chain activities and views about agility through the whole supply chain, global or local sourcing, and onshore or offshore manufacturing. In addition, a direct question was asked to answer the main research question—whether an agile supply chain helps create products closer to the end-user. To ensure that the interview questions were the correct questions to receive the requested data, two pilot interviews were conducted before data collection commenced. The two pilot interviews' process and results showed that, after minor modifications to the interview questions, data collection could commence.

As aforementioned, the data collected in this research were via face-to-face and telephone interviews, which took between 30 and 60 minutes per participant. During the interviews, the participants were prompted using the interview questions, which were sent out prior to the interview (shown in Appendix VI). The questions were asked to elaborate on the various processes employed in the interviewees' supply chain operations. The questions focused on the research problem with the aim of answering the subsidiary questions. Any other information obtained that did not relate to the study was discarded. No personal details were collected, except the position or role of the interviewee in the company.

The interview discussions were recorded with a small recorder and mobile telephone to have back-up recording in case something happened to one of the devices. Of the 12 interviews, only one participant did not give consent to record the conversation. In this instance, notes were taken; however, less data were recorded than in the audio-recorded conversations. The 11 interview records were transcribed into Microsoft Word documents using Digital Transcript ([www.digitaltranscript.com.au](http://www.digitaltranscript.com.au)). The twelfth interview was summarised and also saved to a Word document. All 12 Word documents were imported to NVivo. The project was conducted in the Melbourne and Sydney areas of Australia via face-to-face interviews, and the telephone interviews were conducted with plant managers from Brisbane and Adelaide.



All interviews were confidential and recorded with the consent of the participants. The transcripts were drafted and returned to all participants for approval before any data were analysed. Member checks were used to reduce any bias within the transcripts. Once the interviews were transcribed, they were returned to the interviewees to verify the accuracy of the content (Neuman 2000).

#### **4.8.2 Interviewee Selection**

The targeted organisations were manufacturers in both mass and innovative production. A decision was made by the researcher to approach only certain types of manufacturers that produce appliances, equipment, tools, electronic devices and parts. There are two aspects to this selection. Several other industries are heavily studied (for instance FMCG and automotive), and the selected industry group has the broad variety of operation type, eg. onshore, offshore, mass or innovative production which provided the incentive for collecting the right data for the purpose to answer the research question. Executives, supply chain experts and operation managers were approached with the interview and the online survey to ensure that the participant has the right level of knowledge and experience to answer both the interview and survey questions.

In terms of the interviewee selection in Phase I, the goal was to conduct 12 to 15 interviews with managers in the manufacturing industry because, according to the literature (Creswell 2009), theoretical saturation is expected to occur after completing 12 to 15 interviews. In this study, after 12 interviews, several repetitions had already been established. A good number of repetitions indicates an appropriate base for establishing themes in the data. The main focus when contacting companies was to be able to speak with decision makers regarding production, operation and supply chain management. More supply chain managers should have been interviewed, but very few Australian companies pay attention to supply chain management and optimisation.

For the purposes of contacting managers and to request appointments for interviews, two online databases were selected to obtain the required contact details:

- Manufacturing Australia ([www.manufacturingaustralia.com.au](http://www.manufacturingaustralia.com.au))

- Manufacturers' Monthly ([www.manmonthly.com.au/company](http://www.manmonthly.com.au/company)).

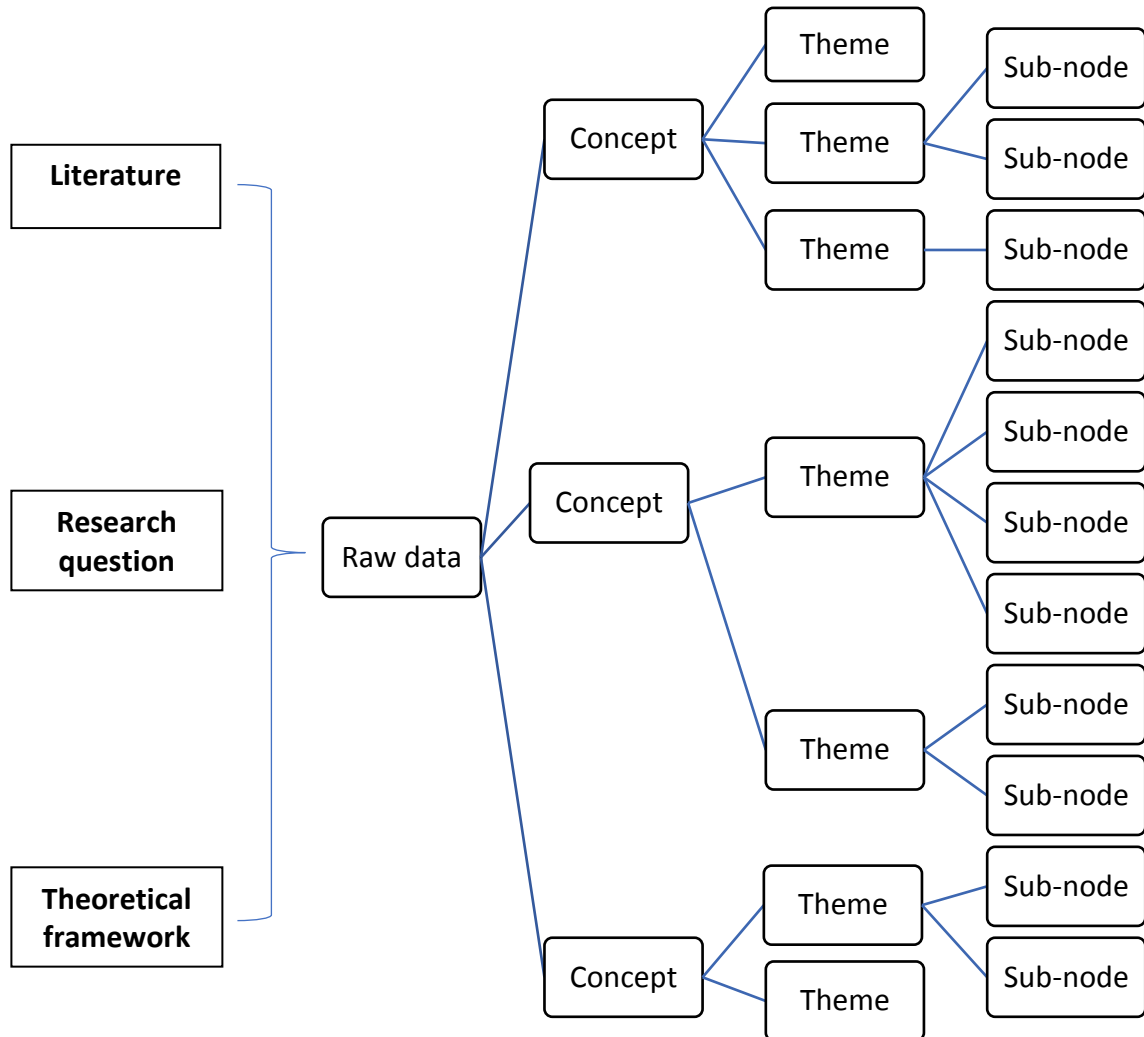
Although these databases contain managers' contact details, contacting managers was still difficult because most managers' direct contact details were not present in the databases. Receptionists frequently answered the telephone, and these receptionists were not allowed to provide direct contact details. In a few cases, when a manager's contact details were not accessible, the website LinkedIn (<https://au.linkedin.com/>) or a simple Google search was used to find the targeted contact details. In LinkedIn, typing the person and company name provided the possibility to contact the person directly through the website; however, receiving a response was not guaranteed. In addition, the Google search sometimes provided a direct email address to a targeted participant, which was the simplest method to access managers. Telephone calls were rarely made because, after the first few trials, there was not much success; thus, the researchers generally sent invitations for research participation by email.

The researchers first sent the study introduction, participant information, contact form and call for research interview documents via email to 27 managers from different manufacturers. Of these, 12 company representatives responded positively to an interview request. The researchers encountered difficulty finding manufacturers within the selected area (machinery, appliance and tool manufacturers); thus, after conducting 10 interviews, they decided to broaden the area. To conduct a sufficient number of interviews, a few more companies were selected from the automotive and pharmaceutical sectors. One participant from the automotive sector and one participant from the pharmaceutical sector accepted the invitation to interview. Of the 12 interviews, seven face-to-face interviews and five telephone interviews were conducted. Appendix III summarises the interview participants' details involved in Phase I. More details of the interview participants will be presented in Chapter 5—data analysis.

## **4.9 Transforming the Data**

Figure 4.2, adapted from Bruno (2011), demonstrates the process of how this study enabled large amounts of raw data to be transformed and broken up into concepts, refined into themes and then reconstructed into categories and ultimately a theory. The research process

allowed the researchers to be both systematic and creative in the analysis. The process illustrated in Figure 4.2 enabled the identification and development of the related concepts and themes that provided the factors to construct a theory through the literature and data analysis.



**Figure 4.2: Transforming Raw Collected Data to Theory (Adapted from Bruno 2011)**

As Figure 4.2 indicates, the established research questions, literature, theoretical framework and data analysis are connected to each other because it is a structured building block that allows each process to confirm or at least connect with each other.

#### **4.10 Data Analysis by NVivo, Phase I**

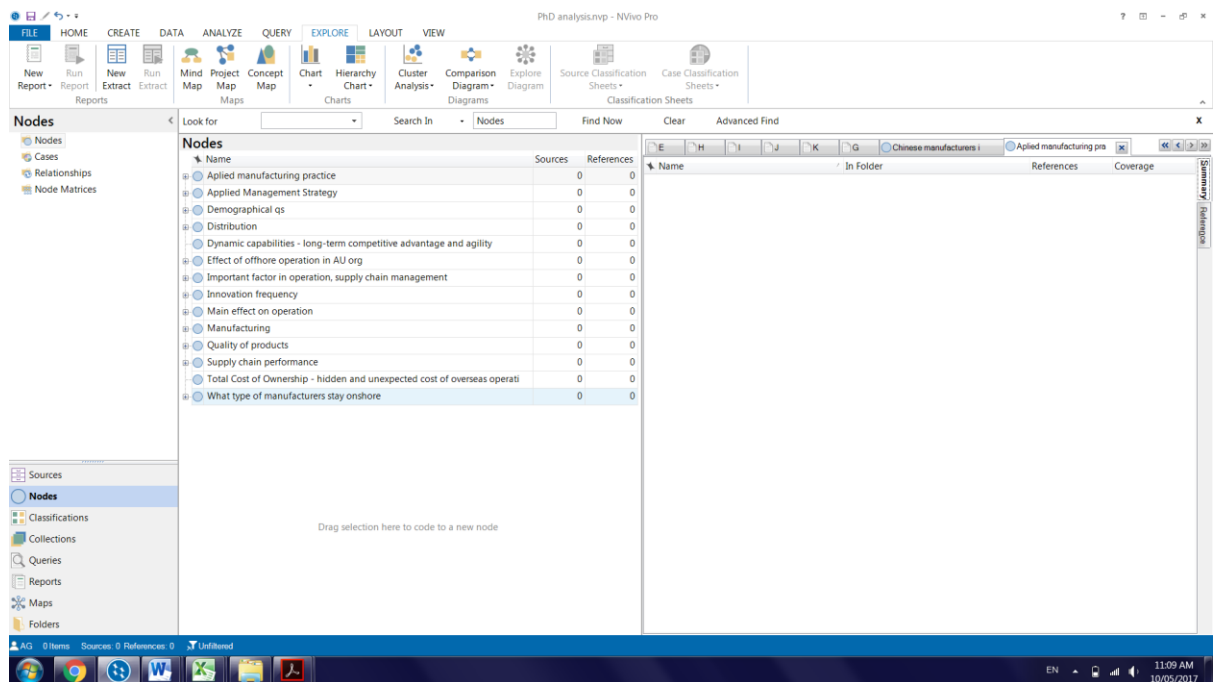
To validate the preliminary data, NVivo analysis was performed. To test the results of manual analysis, in the second phase, data were imported and coded by NVivo. The sampling included a diverse representation of the manufacturing sector, which supports the ability to adapt the results to other businesses that are similar to the ones represented in this study. This supports the transferability of the results to the larger population. The companies were located in the Sydney, Melbourne, Adelaide and Brisbane areas. All except three companies were Australian. Regarding the offshore manufacturing companies, their production plants were in places such as China, the US, Vietnam, Malaysia, India and throughout Australia.

For the purpose of establishing themes and exposing clear results from a robust chunk of information, all the results of data collection were entered into NVivo. NVivo provided tools for this particular study to assist in the following (adopted from Smyth 2010): tracking and linking ideas associated with or derived from data sources; searching for terms or concepts; indexing or coding text or multimedia information for easy retrieval; organising codes to provide a conceptual framework for the study; querying relationships between concepts, themes or categories; and building and drawing visual models with links to data. To conclude, NVivo is a useful software tool to design, prepare and analyse qualitative or mixed-methods data. The following examines the rigours of the methods used.

After all the Word documents were imported to NVivo, the coding procedure started. The approach to find patterns in the data began with identifying main topic areas that correlated with the research questions, the theories involved and the interview questions. As the interview questions were purposely written to obtain answers to the research questions, establishing themes around the research question was the one of the background to establish patterns within the data.

Coding text by NVivo can be very detailed, with word-by-word coding or concentration on only the key themes. In this data analysis, coding and pattern matching focused on the core elements of the study, with themes in the data established according to the research,

interview questions and theory statements. As described earlier, the recorded interviews were transcribed and imported to NVivo as ‘sources’. As indicated in Figure 4.3, 12 main topics were identified as the main nodes from the source document uploaded in NVivo. The main nodes were established as a reflection of the most important interview question topics, such as applied manufacturing practice, applied management strategy, demographical questions, the effect of offshore operations in Australia and Australian manufacturers, important factors in operations and supply chains, innovation frequency, main effect on operations, manufacturing, quality of products, supply chain performance and which type of manufacturers stay onshore. Although there were at least 20 questions in the interview, only 12 main nodes were identified, as those themes were closely related to the research questions.

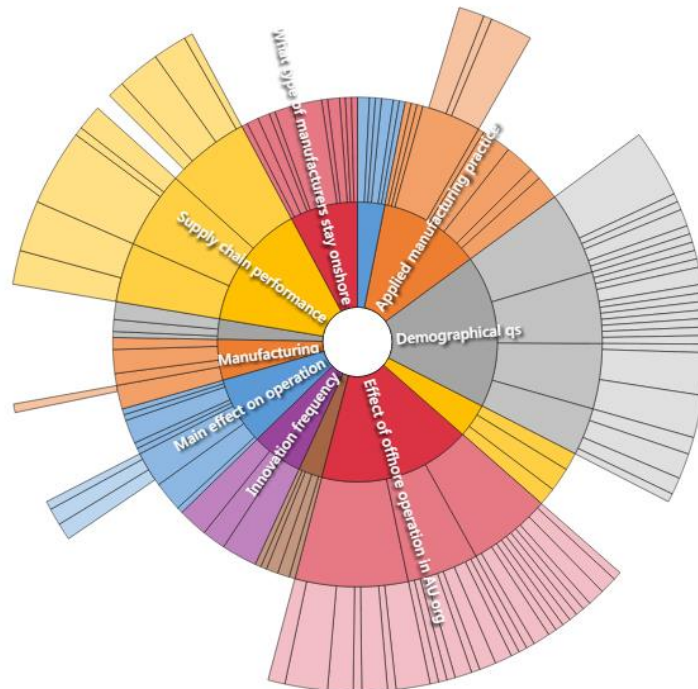


**Figure 0.3: Main Nodes Identified**

In the next step, sub-topics/nodes were identified within the main nodes. Working on the nodes' hierarchy was a continuous process. As aforementioned, the sub-nodes were identified after finding patterns in the responses to particular questions.

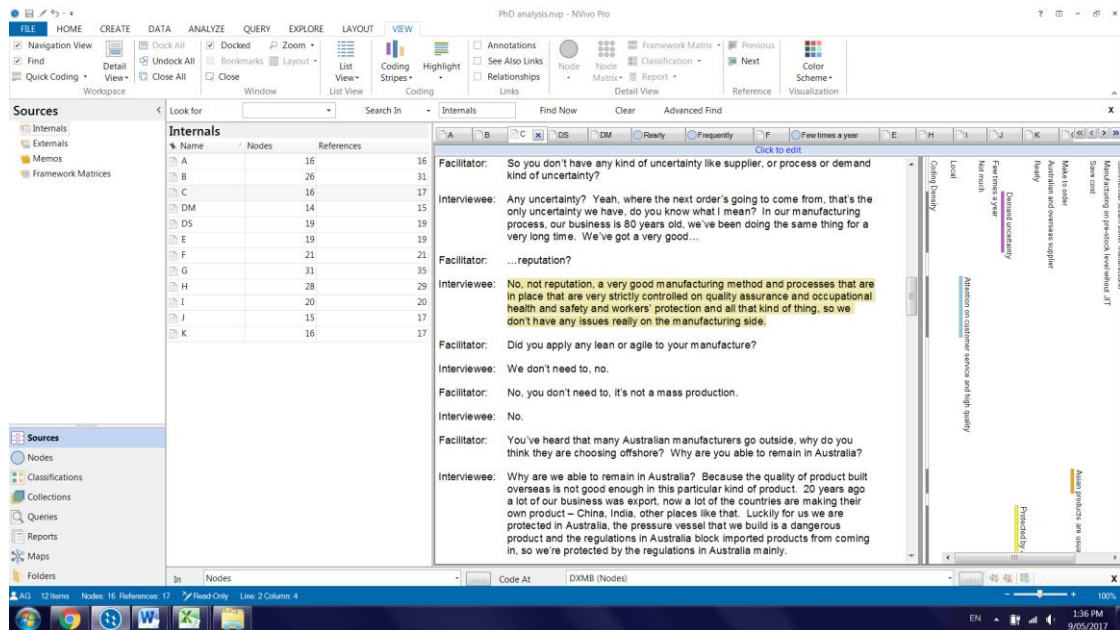
In the first phase of analysis, classifying codes was a preliminary process. At the first site of the data, many more main themes were selected; however, after the first review of the

themes, hierarchy was changed as the final concepts were reduced from 25 to 12. These themes did not disappear, but were sub-coded under the final main concepts. This study included concepts, themes and sub-nodes. All the main concepts had themes, but not all themes had sub-nodes. The original idea was to have only two layers within the hierarchy of codes because this is easier to analyse; however, when the codes were identified, the hierarchy developed a different shape, as different topics were identified to have a similar background. Figure 4.4 shows the three layers of the hierarchy in the different codes. All the main concepts had themes, but only half the themes had sub-nodes. The figure also illustrates the depth of the analysis, with all the different ‘slices’ of the figure demonstrating different established themes.



**Figure 0.4: Hierarchy Chart**

NVivo can code all elements of the sources to new or existing nodes. According to the main themes, 18 to 31 concepts were identified in each dataset. Coding all important themes and patterns provided all the nodes, which then gave appropriate sources to be analysed. Figure 4.5 presents an example.



**Figure 0.5: Establishing Different Codes in the Data in NVivo**

This example indicates the small part of the interview discussion that was coded as the main theme/concept. The theme highlighted with blue on the right was established from the yellow highlighted section as ‘attention to customer service and high quality’. This screen view also demonstrates all the sources, the nodes (themes, patterns) and how NVivo actually codes the text (on the right). NVivo is a great tool for managing all the sources, themes, patterns, codes and nodes, and organising them clearly before analysing the data. The study and the data determine how NVivo can be used in the analysis.

Further, NVivo is able to generate different maps, charts and diagrams from the coded data. Within ‘query’, this study used only ‘word frequency’, as this research and data analysis did not focus on word analysis, but on ideas expressed in sentences differently by each participant. NVivo does not analyse the data, but helps organise themes, patterns and codes. Hence, after coding the data elements, the data need to be analysed manually. The next section illustrates the background of conducting the online survey.

## 4.11 Conducting Online Survey, Phase II

To validate the interview results, a survey was conducted during the second phase of data collection. Based on the outcomes and interpretation of the interview results, survey

questions were established purposely to validate the interview results. In terms of establishing suitable questions, specific questions were created to receive answers that reflected the qualitative analysis results (based on findings presented in Chapter 5.) The data analysis from the interview section provided a set of results with different themes. The survey was designed to validate the findings from the interviews by re-questioning the main themes of the interview results. In terms of the themes from the interviews, some of the themes are considered more, and some of the themes are considered less important in the data. The survey questionnaire was formed by concentrating on the themes and results considered 'more important' in the qualitative data, as well as the themes and results that had a direct correlation with the research questions. Then both interview and survey results of the same themes were compared, analysed and interpreted. Prior to the fieldwork, the questionnaire was reviewed as a pre-test by two academics and one individual from the purchased data base to verify the wording of the survey. The questionnaire is presented in Appendix IX. The questions in the survey were targeted and able to receive answers in a Likert scale. Most questions included a scale of 'strongly agree', 'agree', 'disagree' or 'strongly disagree'. The questionnaire was purposely designed to be short, concentrating only on the main topic questions.

A contact list was purchased from Impact Lists, who provided 1,438 contacts with email addresses and positions in the manufacturing sector all over Australia. After the online questionnaire was sent out to all contacts, 12 responses were received by email from people who were not manufacturers and a few others who either did not want to participate in the survey or were out of office. Data collection duration comprised one month, from 1 June to 31 June 2017. An email inviting participants was sent out five times, and the first questionnaire was followed by four reminders within three weeks. After closing the survey, 119 responses were received out of 1,438 contacts, which was a response rate of 8.27%. This response rate would not be sufficiently high for a preliminary data analysis; however, given that the online survey was conducted to validate the qualitative data, this response rate was sufficient.

The level of response rate is an essential aspect in determining the value of research findings. A high non-response rate creates an increased possibility of statistical biases



(Tomaskovic-Devey, 1994). However, any level of non-response can—but does not necessarily—induce non-response bias in survey estimates (Groves 2006). Therefore, consideration of which rate of non-response is considered ‘too high’ is unimportant (Rogelberg and Stanton 2007). In terms of meta-analysis, based on the work by Cook et al. (2000), response representativeness is more important than response rate in survey research. According to Fan and Yan (2010), it is estimated that the response rate to web surveys, on average, is approximately 11% lower than other survey modes. There are several reasons why the online survey response rate is low. One reason is that over-surveying in a growing number of industries means that employees and managers are flooded with questionnaires (Baruch & Holtom 2008). As a result, large numbers of target individuals or firms are overwhelmed by receiving and finalising online surveys, and subsequently refuse to respond to non-essential questionnaires (Baruch & Holtom 2008).

The purchased contact list contained all different types of manufacturer. This study implemented no particular selection when undertaking data collection through the online survey—the questionnaire was sent to every person on the contact list. The survey participants (randomly chosen) included manufacturers of semi-trailers, automotive components, timber, aviation components, automotive aftermarket parts, sheet metal and wire products, chemicals, steel, tipping components, corrugated cardboard packaging, automation, temperature sensing equipment, liquid fertiliser, clothing, sporting apparel/accessories, mining, sub-contractors to steel fabrication, industrial flow meters, plastic film and bags for packaging applications, custom-made cushions for interior design, kitchens and bathroom cabinets, electrical manufacturing for cathode protection, aluminium windows and shower screens, and tile and stone adhesives and grouts.

The online survey was obtained by the Qualtrics program and analysed with basic statistical analysis. The online survey was separated into four different areas: (i) two demographics questions, (ii) three questions about the type of product and operation, (iii) 12 direct questions about the topic area and (iv) one ‘comments’ question. All of these areas were important to the outcome. The email inviting participants was sent out five times. The data collection period of the online survey was one month, between 1 and 30 June. The first questionnaire was followed by four reminders within three weeks. After closing the survey,

119 responses were received out of 1,438 contacts. Data analysis of the online survey was conducted with a basic statistical analysis, described in Chapter 6. Including the concept of hermeneutical cycle (Myers 1997), the data results were interpreted as a complex result outcome, including a comparison of the literature and theoretical framework. This process ensured the results were accurate and valid. The next sections discuss the research ethical considerations, validity and reliability.

## **4.12 Ethical Considerations**

In Australia, an application of ethical approval is required because ethical issues are considered important to manage when conducting and reporting the results of research (Myers 2009). Ethical practices are regarded as a moral stance that entails honesty, respect and protection for the rights of the individual respondents in the research (Payne & Payne 2004; Ticehurst & Veal 2005). Therefore, this study considered ethical issues prior to data collection. An application for ethical approval was submitted and approved (15775) by the Business College Human Ethics Advisory Network of the RMIT University, dated 19 November 2013 (see Appendix IV). The first ethics approval expired in July 2016 and there was a planned second round of data collection of surveys to validate the interview results; thus, a second application for ethical approval was submitted and approved (20437) by the Business College Human Ethics Advisory Network of the RMIT University, dated 15 November 2016 (see Appendix V).

## **4.13 Research Rigour**

Research rigour has a direct relationship with the quality of research and includes research reliability, validity and generalisability (Neuman 2006, Yin 2003). The topic of rigour in qualitative research has been well established in both case study research (Klein and Myers, 1999, Yin, 2003) and action research (Baskerville & Wood-Harper 1998; Young 2006). The following sections discuss the background of reliability, validity and generalisability, and explore how this thesis addressed these issues.

Researchers of qualitative, interpretive and case study research are aware of the importance of accuracy and rigour (Davison 2001). Relevant information is fundamental and is often

influenced by the flexibility of the research approach. An inappropriate structure may disrupt the rigour of the research (Young 2006). The structure of each research cycle in this thesis included a reflection process performed by both the researcher and industry partner. This reflection included assessment of the research task performed, and any adjustments were reflected in the next research cycle. The structural arrangement of the theoretical framework and structure of each research cycle provided reflection to both the researcher and practitioners, and contributed to the research relevance and validity (Young 2006).

#### **4.13.1 Reliability**

The reliability of a study refers to the ability of the chosen research method to meet the intended purpose of the research and measure the chosen variables (Golafshani, 2003). The research questions were developed from the purpose of the research and the literature review. The interview process involved a structured interview, so that the answers provided were a direct response to the research questions. The interview respondents were allowed to expand on the topic freely, yet the structured interview process assured that the intended topics of the study were covered. The researcher recorded the interviews so they could be accurately transcribed at a later time. This chosen research method is believed to be a reliable way to address the research variables (Creswell 2009).

Theory has an essential role in the case study design and the data analysis (Perry 1998). This research applied a case study analysis to assess the empirical evidence confirming the conceptual framework, which was built upon dynamic capabilities and total cost of ownership theories, and whether the findings call for modifications to the framework (Oates 2006). This procedure does not mean simply imposing theory when analysing the data instead of generating original categories, themes that offers ideas and assist to produce a preliminary theoretical framework that should be considered as a “sensitising device” (Klein and Myers 1999, p 75), which could be modified in accordance with the findings.

A clear structure was used in line with Yin’s protocol for conducting a case study (Yin 2003) and Rubin’s structure of conducting interviews (Rubin & Rubin 1995). The interview protocol used for this research included a participant information and consent form, detailing the aim of the project, data collection and storage methods. Each interview with

an executive management level member of each manufacturer was conducted. For each interview the same set of questions and checklist were used. The coding scheme for both interview and online survey was examined by two academics involved in the research to collaborate on the main themes.

As Klein and Myers (1999) suggested, a set of principles for conducting a research with interviews would be appropriate. This set of principles contains seven stages, such as

- 1) Fundamental principle of Hermeneutic Circle which was detailed in Chapter 4.7
- 2) Principle of contextualization which requires critical reflection to the background of the research
- 3) The principle of interaction between the researcher and the subject which reflects to the critical view of how the research materials were socially constructed
- 4) The principle of abstraction and generalization
- 5) The principle of dialogical reasoning, which requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings
- 6) The principle of multiple interpretations which requires sensitivity to possible differences in interpretations among the participants
- 7) The principle of suspicion, which requires sensitivity to possible biases and distortions in the narrative (Myers 1999)

During repeated cycles of the hermeneutic circle, all of the suggested principles have been applied to this research study, forming a complex web of interpretation.

#### **4.13.2 Validity**

Validity refers to the quality of the research and the soundness of the conclusions that can be drawn from it (Golafshani 2003; Mentzer 1997). This research used two types of coding methods to confirm that similar results were obtained, with the qualitative results validated by quantitative data collection and analysis. Therefore the findings of this study are validated by using these coding and analysis techniques.

Unlike a quantitative study, qualitative studies are often criticised from the standpoint of validity. Quantitative research employs statistical methods that can either support or discredit the validity of the research. Qualitative research has no such measures. The validity of qualitative research is often determined by the number of studies that have successfully used that particular method. In the current study, the researcher used methods that have previously been used to explore similar topics in other studies. The use of structured interviews and coding is a standard method in the social sciences, psychology and humanities.

Several types of bias can affect the validity of a qualitative research method that uses interviews as the primary data collection method. The first type is sample bias (Creswell, 2017), which refers to the presence of certain characteristics in the study group that cause the results of the research to move in one direction or another. When a study contains sample bias, the results cannot be applied to the general population and are only valid for the study population. The nature of this study was not conducive to random sampling techniques; however, the researcher was careful to choose from a range of different sized companies and select a sample that was representative of many major industry sectors. This selection method increased the chances that the results of the study would be applicable to a sample population that lies outside of the study population (Creswell 2017).

Among the several bias, this study only focuses on sample bias, as in terms of this specific research design, sample bias appropriate enough to investigate the validity of the study. This research is considered a valid measure of the intended parameters. The use of the chosen coding methods is also considered an accepted standard method for this particular type of project. The research methods used for this study are considered valid for measuring the intended research parameters.

#### **4.13.3 Generalisability**

Generalisation explores whether the research findings can be applied to another study (Creswell 2009; Yin 2003). As Yin (2003) explained, there are two types of generalisation: statistical and analytical generalisation. Statistical generalisation most commonly deals with presumption, where empirical data are usually collected for a specific sample. Statistical

generalisation is common for generalising results from surveys and experiments (Yin 2003). Analytical generalisation or generalisation to theory is generally applied in qualitative studies, where the study is based on understanding the phenomenon and the findings can be implemented in another study (Yin 2003). Applying qualitative studies to generalise to theory has been well developed by several researchers (Klein & Myers 1999; Lee & Baskerville 2003; Walsham 1995). The current study used analytical generalisation; thus, the findings can be applied to other settings or organisations.

Considering the level of credibility of this research, two types of coding methods were used to confirm that similar results were obtained. The first was thematic coding, which helped analyse the qualitative data, and the second was analysing the questionnaire results with basic statistical analysis to confirm the interview data results. The chosen coding methods are considered an accepted standard method. Therefore the findings of this study are validated by using these coding and analysis techniques. In terms of transferability, the research questions were developed based on the purpose of the research and from the literature review. The interview process was a semi-structured approach, with interview questions developed to answer the research questions. The online survey validated these findings. This chosen research method is believed to be a reliable way to address the research variables.

#### **4.14 Summary of the Research Method**

This chapter has outlined the possible range of research strategies and the chosen approach. In terms of research classification, this study is qualitative research, with the data used to understand the decision-making process of evaluating strategies of value delivery primarily sourced from interview data (Creswell 2017; Staller & Salkind 2010). This study is exploratory research that can be categorised largely through the paradigm of positivism, given that the common characteristics of positivism can be described in terms of logically linking abstract ideas to precise measurements of the social world (Neuman 2006; Wahyuni 2012).

The research situation aligns with qualitative research. The research design had several stages that helped demonstrate rigour. Regarding the research approach, case study was

used to explore the phenomenon with semi-structured interviews because, when a researcher has sufficient knowledge to develop question about the case, but not enough to anticipate the answer, semi-structured interviews are the optimal method to choose (Richards & Morse 2013; Yin 2003). This study used a NVivo analysis, and employed a survey to confirm the qualitative findings. The next chapter summarises the data analysis flow and the findings of the study.

## **Chapter 5: Qualitative Analysis**

### **5.1 Introduction**

This chapter describes the analytical approach and results of the data analysis, focusing on the qualitative analysis of the interviews conducted with the managers of manufacturing companies. The analysis and interpretation of the data obtained from the interviews enabled the researcher to obtain a better understanding of the response to the research question: how can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user?

The main sections of this chapter are as follows. Section 5.2 presents the established themes gained from the NVivo-assisted analysis. Section 5.3 discusses the correlation between the product type and the type of manufacturing operation. Finally, Section 5.4 summarises the qualitative analysis of the study.

### **5.2 Data Analysis with the Assistance of NVivo**

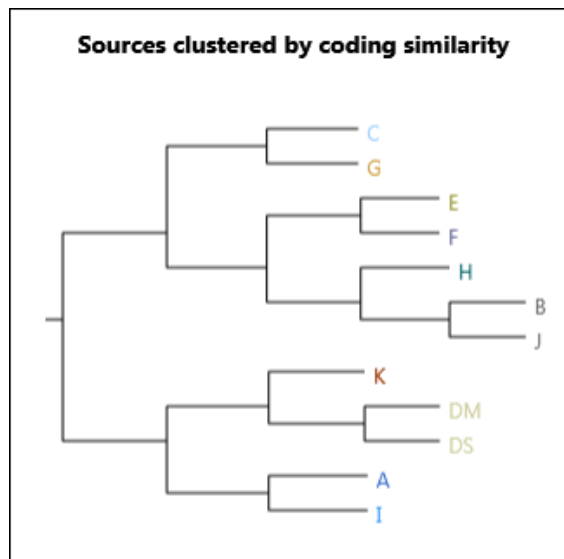
This section presents the NVivo-assisted data analysis. The data obtained from the interviews were analysed with the assistance of NVivo to identify the similarities and differences between the results. The hermeneutic cycle—the method discussed in Section 4.7—helped accomplish rigorous analysis in the NVivo-assisted analysis.

Once saturation is reached in the analysis process, exploring the literature allows the researcher to draw on the literature to either confirm or disprove findings, and/or explore whether the literature has any correlation with the findings (Strauss & Corbin 1998): ‘Bringing the literature into the writing not only demonstrates scholarliness but also allows for extending, validating and refining knowledge in the field’ (Strauss & Corbin 1998 p.17). Via a simple tool in NVivo, this study’s main topic could be confirmed by generating a ‘word cloud’, which is presented in Appendix VII. This cloud was generated by displaying the 100 most frequently used words, including words of four or more characters. The next section provides a detailed overview of the most important themes found in the NVivo-assisted analysis. Less important themes are presented in Appendix VIII.



### 5.2.1 Similarities between Interview Participants

Figure 5.1 was generated by NVivo to demonstrate the similarities between sources (companies) by clustering coding to present connections between the companies and to make those connections more transparent. To explain the chart from the bottom to the top, the similarities are as follows. The main root at the bottom demonstrates the companies who had overseas production. Companies A and I are both global companies with world-class operations, production and supply chain systems. In the same main root, yet different sub-root, are Companies K, DM and DS, who are Australian companies with offshore production, yet distribute products mainly in the Australian market. DM and DS are sibling companies, with different departments in Sydney and Melbourne.



**Figure 0.1: Sources Clustered by Coding Similarity**

The second main root going towards to the top of the chart concentrates on companies of Australian manufacturers producing within the Australian borders. Companies C and G have a unique similarity because they both stated that they do not have demand uncertainty; thus, their productions are stable. All the remaining five companies (E, F, H, B and J) had demand and other uncertainties in the market, which made their operations volatile. Within the five companies, H is separately mentioned because, although they were producing partly for the ‘leaving’ automotive sector, their production, operation and supply chain management were wise and noted all the disadvantages of producing offshore. Companies

B and J were also similar because most of their products were made-to-order; hence, their production line and operation had to be very flexible. Companies E and F both produced small products mainly from steel, which required a long lead time to arrive and a huge raw material stock. Based on this visual analysis tool, original connections could be demonstrated within the elements of the data.

### 5.2.2 The Established Themes

As presented in the hierarchy chart in Chapter 4 (Figure 4.4), themes were established under three different levels. The main themes (called ‘concepts’) distinguished the different ‘themes’, which were then separated into different sub-nodes. There were many different themes and sub-nodes under the main concepts; however, the flow of analysis below only presents the main themes that answered the research questions and other important topics that emerged naturally through the analysis. Table 5.1 shows the established themes and result of the interview study.

**Table 0.1: Established Themes and Result of the Interview Study**

<b>Established themes in the interview study</b>	<b>Interview study result — analysed by NVivo</b>
Number of employees	Most participants were from small or medium-sized companies.
Site location	58.8% of the interview participants have the production site in Australia
Offshoring Reasons	Production moving overseas because of price competition
Flexibility and Agility	It is important, organisations apply agility and flexibility but mainly for their core company. Most of them do not apply supply chain techniques, thus they don’t optimise the information and good flow throughout their supplier and distributors
Management Strategies	Applied operation strategies are not focusing on advanced supply chain management techniques Australian manufacturers are following the trend to move offshore, instead of trying to apply successful operation, management or supply chain strategies
Negative Effects of Offshoring	Negative effect on the Australian economy Difficulties with transportation and lead time from overseas
Recent trend in Operation and Supply Chain Management	Sharing demand and forecast information is not frequent enough. Advanced supply chain techniques are applied only by large manufacturers
Main Effect on Operation	Demand uncertainty, lead time. Difficulties with quality and

	inventory when goods, parts or raw materials come from overseas
Supply Chain Performance	Materials and parts supply is mainly from overseas, huge inventory, long lead time
Benefit of Onshoring	Certain manufacturers are able to operate in Australia, such as 1) manufacturers with high technology who can high value add (innovative product manufacturers); 2) with a defined market strategy; 3) that apply high technology and are able to export; 4) in industries where a quick response is important; 5) applying agility and flexibility in everyday activities
Lacking TCO calculation	Organisations do not calculate invisible, hidden and unexpected costs when moving offshore
What type of manufacturer can stay in Australia	Mass production overseas; customised production in Australia
Not enough investment in manufacturing sector	Manufacturers and/or government are not investing enough in manufacturing sector

The next part of the study is detailing the established themes and the results of the interview study.

#### *5.2.2.1 Demographical Data*

The interviewees of top executives from the manufacturing firms included business owners and executive managers from a variety of industries. The industries included a transformer manufacturer, a commercial steam boiler manufacturer, a small domestic appliance manufacturer, three automotive manufacturers, a commercial storage system manufacturer, a security device manufacturer, an industrial fastener manufacturer, a commercial storage and pallet racking system manufacturer, and a valve and control system manufacturer and distributor.

Six of the participant companies were Australian owned and onshore (in Australia) operated, one of them was Australian owned and had production sites in both Australia and several other countries, and five had offshore (overseas) production sites. None of the five offshore production sites were owned by the Australian organisation. The different manufacturers were purposely selected to offer an analysis of an almost equal variety of

onshore and offshore operations. Table 5.2 describes the details of the interviewees' demographical data.

**Table 0.2: Demographical Data of the Interview Participants**

	Company	Company profile	Headquarters	Manufacturing site	Company origin	Product type
1	A	Automotive	Adelaide	Thailand	US	Mass manufacturer
2	B	Automotive component and container manufacturer	Adelaide	Adelaide, China and Malaysia	Australia	Mass manufacturer + custom manufacturer pull system
3	C	Steam boiler manufacturer for commercial use	Sydney	Sydney	Australia	Built-to-order + built-to-stock
4	DM	Commercial storage system manufacturer	Melbourne	China, the US and Vietnam	Australia	Mass manufacturer + built-to-stock
5	DS	Commercial storage system and steel pallet racking system manufacturer	Sydney	China and Southeast Asia	Australia	Mass manufacturer + built-to-stock
6	E	Industrial fastener manufacturer	Melbourne	Melbourne	Australia	Mass manufacturer + built-to-stock
7	F	Security device manufacturer	Melbourne	Melbourne	Australia	Mass manufacturer pull system
8	G	Valve and control system manufacturer and distributor	Sydney	Houston, India and China	Australia, but US mother company, only customisation in Australia	Built-to-order, customisation only
9	H	Automotive and industry battery manufacturer	Brisbane	Brisbane	Australian origin, but sold to foreign stakeholder	Mass manufacturer pull system
10	I	Biotechnology manufacturer	Melbourne	Melbourne	Australian global company	Mass manufacturer, built-to-order + built-to-stock

11	J	Transformer manufacturer	Melbourne	Melbourne	Australia	Built-to-order + built-to-stock
12	K	Small domestic appliance manufacturer	Sydney	China	Australia	Mass manufacturer + built-to-stock

#### 5.2.2.2 Theme 1: Offshoring Reasons

A theme emerged from the data about why manufacturers move offshore. Of the 12 respondents, six companies (A, DS, DM, G, I and K) had offshore sites, but for different reasons. Company G imported finished and semi-finished products from India, Houston (their mother company) and China, and only customised products in their Sydney facility. Company A was a global company that had a manufacturing site in Australia, yet had recently moved out because of the high operational costs involved in Australia.

Companies DS and DM were Australian organisations, but had recently moved their product line to China because they were unable to handle the intensely increasing costs in Australia. Company K had also moved offshore. This company was an Australian mass manufacturer with a long Australian history. They were not a frequent innovator and their production did not require high technology. According to their report, regarding cost-effectiveness, both Companies DS and DM were able to produce more affordably in Asia, including all the shipping and other costs involved with offshore operations. Company I was an Australian organisation with different sites all over the world, as well as two sites in Australia. They had sites in every continent to be closer to their customers.

The remaining six companies (B, C, E, F, H and J) produced in Australia and imported raw materials or parts from overseas. Some of them also imported finished or semi-finished products. Company H produced three-quarters of its finished product in Australia, and imported one-quarter of the finished product from overseas to be able to serve all of its customers with different budgets. Company E's percentage of imports comprised 60% imports and 40% local. The local percentage used to be a lot higher—with 80% locally made and 20% imported—but pricing pressure from the industry forced them to import. They have been importing now for at least 15 years and have some long-established suppliers. Most of the products that they import are from Taiwan. They also manufacture locally and supplement the orders to provide customers with all the products they need.

For the question of whether any of the onshore manufacturers plan to go offshore, Company B reported that they are not planning to establish a manufacturing plant overseas; however, in November 2014, the manager visited China and contacted some companies there, and they are beginning a partnership for products that the overseas company might be able to supply and be competitive. With this approach, Company B may be able to win products that they were previously quoting and not winning; thus, they may win more jobs if they have those products manufactured offshore.

According to Company B's representative, the high Australian dollar also affects some companies in terms of buying raw materials at a very high price, compared with buying products from Asian suppliers. In terms of wages, it is a case of finding suitable employees and paying appropriate wages, in a context where it is difficult to compete with offshore suppliers who can provide products at a lower price than their Australian raw material cost. Thus, overall, as indicated by the above discussion, Australian companies are encountering difficulties because of the high costs of Australian labour, raw materials and other factors.

#### *5.2.2.3 Theme 2: Flexibility and Agility*

In the literature, agility and flexibility are discussed as being two different terms (Goldhar & Jelinek, 1983; Goldman et al. 1995; Baker 1996) (discussed in Section 2.7.2); however, in the business context, they have a similar meaning. The literature review in the first part of this study highlighted a difference between the two terms; however, after the data collection results were analysed, agility and flexibility appeared to be synonymous as interpreted by the interviewees.

Of the 12 interviews, five participants (B, E, I, H and F) responded positively or stated that agility and flexibility are very important in their organisation. According to one participant (I), because of strong competition in the marketplace, manufacturers must be very responsive in the short term, otherwise they will lose some of their market:

to respond quickly, the demands will potentially flip very quickly in the season and you've got to be able to respond to that quickly. I think agility is really important because, if you don't hit a date, they'll just go somewhere else. It's a commodity and a

completely transferable between one manufacturer to another, so if you miss a date, you're out (I).

The same participant (I) stated that operational and supply chain cost can be reduced by applying agility. In this instance, the interviewee used term 'agility' in terms of being closer to the customer:

we've tried to get as close to the market as possible. I think that's one way that we've tried to put a bit of agility and reduce our supply chain cost just generally (I).

Three other participants (F, H and B) described flexibility as adjusting operations to customer demands, yet also decreasing costs, decreasing the inventory, improving efficiencies and increasing the service level. One manufacturer (H) stated that, without flexibility, they would not be able to manufacture in Australia. The key factor in their operation was flexibility and responding promptly to customer requirements, which they achieved with the production type of 'quick changeover'. Other participants described that a sustainable operation needs both flexibility and innovation:

I think that is one of the keys to our existence is ability to be flexible and respond quickly to customers' needs. Their needs change a lot, and if we weren't flexible, then all we'd be is an alternative to a Chinese supplier, so the key to us being here is the fact that we can change course relatively quickly and respond to specific questions our customers have in relation to making something that's quite unique to them (H).

Four manufacturers (B, E, F and H) who had their production sites in Australia stated the crucial importance of agility and flexibility. They adapted to be flexible as required by the current business environment. They stated that, without flexibility, they would not be as effective and would not be able to react to customer demand. One respondent (C) explained that they have tried to implement agility, but have not yet succeeded. Another manufacturer (G) viewed the importance of flexibility mainly in terms of customer service:

Well, what I'm saying is, we bring in products from our manufacturing in China and India and Houston, and that's very much about repeatability. So it's about high volume repeatability. So what we do is we bring in these parts, we bring in finished goods, semi-finished goods, raw material and then what we try and do—and when I talk about

customer service, I talk about flexibility. So our ability to take what we get from our supply chain and construct that into something that suits the customer's needs (G).

The importance of agility was not highlighted by other participants. Some of the participants did not have demand uncertainty or did not need to be flexible and agile because of their products' features. In other instances, companies operated with an 'old-school system' and were unaware of the latest management and supply chain techniques, such as how to manage whole operations and supply chain flexibility and agility. This finding raises the question of whether Australian manufacturers work sufficiently effectively, or whether they should implement different management techniques before considering going offshore. The result of the following analysis will provide answers to this emerging question.

Agility and flexibility were one of the key questions of this study because, according to the main research question, flexibility and agility in production, logistics and supply chains should be able to assist certain manufacturer to be efficient, save costs and be able to produce closer to the market (end-user).

#### *5.2.2.4 Theme 3: Management Strategies*

Certain management strategies involved in manufacturer operations may add benefits to achieve long-term competitiveness. Several knowledge-based management strategies were mentioned in the data collection process, which is really satisfying but most of the sophisticated supply chain activity which involvement in an operations can sustain long-term competitive advantage were used by only two (H and I) organisations.

Different managers interpreted 'management strategy' in different ways. For instance, two of the respondents (G and C) stated that their management strategy is about customer service and high quality:

a very good manufacturing method and processes that are in place that are very strictly controlled on quality assurance and occupational health and safety and workers' protection and all that kind of thing, so we don't have any issues really on the manufacturing side (G).



our strategy is about customer service and it's about high-quality product (C).

Another respondent (J) mentioned quality control, occupational health and worker protection. Three company representatives (I, G and F) mentioned the importance of manufacturing or customising closer to the customer:

So what we're trying to do is get our final stage of production as close to the market as we possibly can. So we're not shipping it there. Around the world, you want to ship product as concentrated as you can because Australia's a long way away from everywhere, so we spent a lot of time really looking at every—almost a forensic view of every cost element is what we do together (I).

we've tried to get as close to the market as possible (F).

Company DS's and DM's management strategies were based on a sales and operation planning process:

We apply sales and operations planning process (DM).

Well we have an integrated sales and operating plan, for example. That's probably the main one (DS).

Another company (B) saw potential in reducing automotive products and concentrating on other products that are regularly needed in Australia:

Yes we do, one of the strategies we've had in the last five years is to diversify away from the automotive industry and try and find products that are more regularly needed to be made here in Australia (B).

The only participant (A) from the car-making industry stated that they implement a lot of benchmarking of competitive products. They had implemented a 'tear down' strategy, which was based on determining the competition's processes by breaking down products into specific elements, such as estimated cost:

Well, I think we do a lot of benchmarking of competitive product. We do what we call 'tear down', so if we're doing like the Fiesta, we would tear down like say, for example, a Toyota Corolla, or here in Australia on the Falcon, we would tear down the competitor

which is a Holden Commodore, and tear down even to every component to measure them for weight, technology, estimated cost, etc. So we do a very, very thorough evaluation of the components. We also do a thorough evaluation on financial health check on the supply chain as well, and we categorise them as like red, yellow or green, for the financial condition of the supply chain as well (A).

Regarding the question of the management strategy involved in operation, the participants applied useful strategies, yet most were unaware of many supply chain strategies that could help them gain long-term competitive advantage. For example, these supply chain management strategies could include business rationalisation; regional planning; synchronisation; supply chain strategy alignment; business integration; outsourcing; retailer/supplier alignment; collaborative planning, forecasting and replenishment (CPFR); and supply chain optimisation (such as distribution network design and supply chain mapping), to mention a few. Out of the twelve participants, only one (I) mentioned CPFR as a strategy which is one of the main strategy of today supply chains.

This study demonstrates that Australian manufacturers rarely apply supply chain management, even though these activities could improve efficiencies and cost savings. Without the knowledge of how to manage the entire supply chain effectively, an organisation can lose the possibility to gain long-term competitive advantage.

#### *5.2.2.5 Theme 4: Distribution*

Gaining knowledge about companies' distribution activities is also important in terms of their management strategy. It was interesting to investigate whether Australian manufacturers distribute locally or globally, or produce mainly for export purposes, as well as the reasons behind having a large proportion of imported parts or global supply chain activities. Of the 12 participants, two organisations (A and I) had global distribution, five (K, C, G, B and H) had local distribution only and five (F, E, J, DS and DM) sold products locally and overseas. One local company explained that they were trying to move their production away from the automotive industry because it is difficult to find customers in Australia; thus, they sought export opportunities in Thailand:

So we took the approach about three years ago that we could see the automotive industry in Australia coming to an end, so we had a business plan in place to say that what we were going to do, were we going to exist after the car companies disappeared, and so we put a plan in place to actively seek export work and that's mainly in Thailand. So for the last three years, we've been developing contracts there. We've won quite a few contracts (E).

A successful Australian manufacturing strategy is to gain a global presence. Company I was an Australian company that had manufacturing sites on almost every continent to be closer to the customer. Although their global share on the market was only 1%, they believed it was worth opening new facilities closer to the end-user:

So what we're trying to do is get our final stage of production as close to the market as we possibly can. So we're not shipping it there. Around the world, you want to ship product as concentrated as you can because Australia's a long way away from everywhere, so we spent a lot of time really looking at every almost a forensic view of every cost element is what we do together (I).

our products are available through local offices around the globe (G).

Of the 12 participants, five companies distributed only in the Australian market. Of these five companies, one (G) imported semi-finished or finished products from all around the world and customised products in Australia, one was an offshore company (K) and three (B, C and H) exclusively produced and distributed for the Australian market:

We've got a lot of major customers that range from automotive, lot of now smaller manufacturers of electrical goods and electronics, retail companies in Adelaide and a lot of the wineries and that from South Australia and beyond (B).

our customers is a very broad range of customers, anyone using steam and hot water in commercial fields, so it could be anything from hospitals, universities, hotels, pharmaceuticals, petrochemical, any kind of food manufacturing industry—basically any industry that's using steam (C).

So you're manufacturing wholly and solely for the Australian market (K).

Companies F, E, J, DS and DM distributed in Australia and a few other countries, which is a useful solution because it means they can explore and cater to other markets, as well as having the advantage of gaining more opportunities and more turnover:

Well, we sell mostly to Australia, we have around 20% of our sales overseas, half of that is in New Zealand and the other half is in Asia—Malaysia, Singapore, Indonesia (F).

The above examples represent the views of Australian manufacturers. Whether producing offshore or manufacturing for export purposes, many Australian organisations in the manufacturing sector are seeking alternative solutions to avoid closing. However, sending production offshore can be a negative effect to Australia because of its disadvantages to the Australian workforce and different knowledge base activities. According to three interview participants (E, B and H), manufacturing in Australia for the Australia market, while investigating the possibility of exporting products, would be the ideal solution:

As long as you can export it. Australia doesn't have the size of market to necessarily just support its own—you have manufacturers that support its own base. I mean, you've got to be able to export. You've got to get scale. So if you have a really innovative and differentiated product, then there's no reason why you can't manufacture, but you've got to be able to export it. You can't just try and serve it to our market because our market is quite small compared to other regions (G).

So I think there is a role for manufacturing in Australia, but it has to be high technology and high value add—that's for the domestic market—and if it's for export, it also helps if it's sort of easily exportable, like low logistics or whatever, so, in other words, low weight, low bulk, making it easy to export (A).

In addition to examining whether these companies distributed locally, globally or both, it was interesting to examine whether they worked closely with their distributors, had weekly or daily sales forecasts, or/and had the same information technology system as their distributors.

Increasing numbers of Australian manufacturers have realised that they should not produce exclusively for the Australian market, but should focus on exports as well. They should build up a distribution network or at least offer their products overseas:

In terms of plant location, number one is probably having a strong domestic market for the product you're going to manufacture, and also the possibility of a strong export market (A).

#### *5.2.2.6 Theme 5: Positive Effects of Offshoring*

The participants were questioned on their views concerning offshore manufacturing. The responses can be categorised into three main topics: reducing costs, increasing value and offshore operation as having a negative effect on Australia and Australian manufacturers. The purpose of separating this question in this manner is to generate a clear view of respondents' ideas about offshore/overseas production.

According to the respondents' answers, offshore manufacturing as an advantage was grouped into two main views: reducing costs and increasing value. In the area of reducing costs, three interviewees (F, K and I) stated that mainly commodity and bulk manufacturers go overseas. Company F pointed out that, if the product is a commodity and customers are only interested in buying the cheapest product, then it is understandable why manufacturers are moving overseas. According to Company K, who had similar thoughts to Company F, offshore bulk producers are able to capitalise on manufacturing efficiencies, purchasing raw material and economies of scale in ways that manufacturers who produce solely for one market cannot do:

I think your shipping costs can be reasonably cheap if you manage it well. So I'm not sure the shipping cost will offset, they might, depend if it's bulky product, they might—you just have to do the financial analysis on it, wouldn't you. But I, generally speaking, I think if you're producing an awful lot of it and it's reasonably small to ship around and it's a commodity and there's no real differentiation, it's got to be tough to do it in Australia (I).

One of the participants also mentioned that it is difficult to compete to produce in Australia because of a combination of free trade agreements, exchange rates and Australia's high labour rates compared with other markets:

where it is difficult is competing with the offshore suppliers of finished product that can basically bring it in cheaper than our raw material cost is. As you are aware, it is extremely hard (B).

Another two participants (B and E) stated that, for companies involved in mass manufacturing of a low technology type of product that is generally produced in countries such as China, Korea, Thailand or Cambodia, Australia would be unable to compete. Companies A, H and K reported that Australia is much more expensive than Asia:

There are some products that are not expensive that we could source, in both Australia and import from India, as they were small value or small added value items, we could not justify to pay three times the price for the same quality (H).

Company A's representative stated that high exchange rates make exports more difficult and create more import competition. Another problem is the free trade agreement with Thailand—unfortunately, this is a one-way agreement, whereby there are very few exports from Australia to Thailand, yet many imports of products and components from Thailand. Company A's participant stated that the costs to manufacture in China are significantly lower than those in Australia. Companies also have significant benefits in forming partnerships with factories in China, who have many other customers who share the cost of the manufacturing process.

Regarding the costs associated with offshore manufacturing, five interviewees (A, H, DS, DM and C) stated that companies go offshore to save costs. Only one participant (DM) stated that they were able to produce better quality overseas than in Australia; however, this company was not working in the high-tech industry and was not a frequent innovator:

The advantage is that we get a much cheaper landed product at equal to or better quality ironically than what we could do [in Australia], and we have flexibility in terms of what those plants can make. So we can innovate more quickly. That's in our industry. I'm not suggesting we're a high-tech industry—we're not (DM).

Another manager (DS) stated that, operationally, it costs more to produce overseas; however, the cost of manufacture is lower; thus, overall, the cost is lower. Many companies

also stated that labour costs overseas are much cheaper than in Australia. Two participants (G and I) explained that, to be competitive, more companies have to go offshore:

I think manufacturing in Australia is really tough. I think our labour costs are really quite high, so, for a non-differentiated offering, probably going to be—if you're competing on price, ultimately, Australia's a really tough place to manufacture stuff (I).

Thus, it can be concluded that the majority of managers who responded to questions concerning reducing costs with offshore manufacturing stated that commodity manufacturers mainly go offshore because the exchange rates and labour costs are very high in Australia. These factors make it difficult to compete with Asian suppliers, and mass manufacturers cannot compete in Australia. To be competitive, they have to go offshore to compete with Asian suppliers.

In terms of the idea that overseas production can increase value, there were a few different groups of responses. According to Companies A and DS, more manufacturers are going offshore to access larger markets—Australia is too small a market for some manufacturers. For example, as discussed by the only automotive company in this research, 10 years ago, the volume of the supplied product might have been 80,000 and 90,000 pieces for one model. Now, the highest selling car in Australia is only 35,000 units per year; thus, the opportunity for high volume is no longer there. As such, Australia does not necessarily have the market size to support its own manufacturers.

Moreover, Company A's representative stated that manufacturers did not invest enough money in the sector, and now they are struggling to operate successfully:

I think many of the reasons why people go offshore is because Australian manufacturers have invested very little over the last 10 to 15 years and as a consequence to that lack of investment the bridge to catch up is just far too great now. That would be my personal view (A).

Meanwhile, two participants (DM and K) stated that it is better to go offshore if the product variety is large. It is better to work with four, five or seven different manufacturing plants

in Asia who have the capability to make any product, instead of making large investments in fixed machinery in Australia that can only make a certain type of products:

If you were manufacturing only a handful of lines, I can see a real benefit, if you had significant volume over a handful of skews, there'd be a significant benefit, but Kambrook itself has over 200 skews—well, you can't have 200 production lines (K).

One respondent (DM) stated that Chinese manufacturers tend to produce only bulk because, typically, Asian consumers are not interested in sales, marketing and distribution. The Chinese companies are only interested in scale and manufacturing in bulk, and want to deliver in 40-foot containers, not small bags.

According to another manager (C), the offshore manufacturing trend has arisen for the purpose of increasing value. Another respondent (E) stated that, in regard to increasing value with offshore operation, manufacturers commonly perform research and development (R&D) in Australia, yet produce overseas. Although companies may have intelligence in terms of the people and staff designing and developing products, they cannot manufacture in Australia. Thus, they develop products and then one of their manufacturing sites offshore creates the parts for them. However, in contrast to this, another participant stated that:

It doesn't make sense to have our engineering department here. What for? We can design it, but how can we test it? (F)

One of the participant company managers (E) who produced automotive parts stated that, already, most companies with whom they worked had moved their purchasing department to China and global companies. Thus, it is very difficult for them to win business when the buyer is located in China, as they will naturally favour Chinese suppliers in the automotive sector.

Companies K, DM and DS purchased steel as the raw material for their production. However, they had difficulties with steel supply because of a couple of structural problems in the industry in Australia, not least of which is the existence of a single supplier for raw materials. This steel supplier sets an import parity price that makes the finished product



uncompetitive with an imported product; therefore, steel is the major cost for these manufacturers:

It's only the raw materials because you can somehow gain with the wages in Australia, but it's really just about the raw materials, I think, because you need 90 days lead times from ordering to get here, and it's quite a big time investment, many things, warehousing—from this, you could change over to the high Australian wages (K).

According to another participant (C), skilled labour and available technology are also key elements in the manufacturing sector, and Chinese manufacturers are catching up. Further, according to manager of company K, Australia is a small market, and thus, sometimes the volumes are probably not enough to fill one factory for a full year.

#### *5.2.2.7 Theme 6: Negative Effects of Offshoring*

In terms of offshore production as a negative effect on Australian operations, the participants provided several different answers, such as the belief that Australia cannot be a great country without a manufacturing sector, production in Asia is a logistics exercise, there are problems with serving customers on time, overseas companies do not support the Australian workforce, there are significant risks with offshore production and not all factors can be measured, there is a longer lead time, companies are more open to competitive risks, and R&D and manufacturing cannot have large distance. To demonstrate these statements, a few examples are provided below.

One of the participants (E) stated that Australia cannot be a great country if it is supported by only the mining and service industry:

I don't think Australia can survive on just service and mining—the service industry, tourism and mining. You know, we will be one of only two developed countries in the world that will not make motor vehicles—the other one's Qatar. So it's pretty damning in terms of development as a manufacturing nation, that's why I'm saying I can't see it surviving for three years (E).

As mentioned in the literature review, manufacturing has an important role in the economy and development of a country. In numerous cases, the manufacturing sector contributes

primarily to the modernisation and expansion of a country (ABF 2011). There are only few examples of countries with high living standards where the manufacturing sector did not significantly contribute to economic output (ABF 2011).

Regarding the question of the participants' views about offshoring, Company A highlighted that there is a problem with free trade agreements, such as the agreement with Thailand, which is a one-way agreement, whereby there are very few exports from Australia to Thailand, yet many imports of products and components from Thailand. Two participants (C and DS) stated that offshoring is a logistics exercise, such as manufacturers having more inventory and undertaking more end-to-end integration in the supply chain. Another two managers (H and F) stated that going offshore is not always a good solution:

But I would like to hope that, with quite a few years of experience, most people should have that awareness of it's not all nice and good to import goods (H).

Well, only from a patriotic Australian point of view, I think a shrinking of the manufacturing sector in Australia is bad because what happens is you lose designing and mechanical engineering skills and you lose the manufacturing base ... So from our business model point of view, our objective is to respond quickly to customers and have a point of difference—Australian made, we'll make it in eight days. Whereas if you get it from overseas, nothing is done in eight days; it's a different way of doing business (F).

Going offshore sometimes creates problems with serving customers on time, unless companies maintain a large stock, which can be a huge investment in warehousing, logistics and keeping the stock level always accessible (C). Another opinion was that production and R&D cannot have a large distance because Australia has a skilled workforce to develop products, yet companies cannot test new inventions if the production line is far away and is operating under a different ownership who is interested only in manufacturing in bulk.

One interview participant highlighted another problem with offshore manufacturing—the longer the lead time, the more companies are exposed to competitive threat. Further, according to another participant, there is significant risk when moving offshore and not all factors can be measured:

for instance, you can get cheap products from China, but there is a big risk involved and we had an example two or three years ago where the battery industry in China has been completely devastated with the government having some new strong legislation and auditing all the factories. So you have just been relying on people that usually you don't have a true and strong control on, where there's not a real transparency. So, yes, there is a massive risk and, you were right, people don't measure everything (H).

Another manager stated that companies with offshore operations do not support the Australian workforce and economy, and can force other companies to also go offshore:

I believe lot of companies move their manufacturing offshore ... basically hasn't supported the Australian workforce and economy, but people who are outsourcing for cheaper cases, it basically is forcing other companies to do it. Basically, we were in a situation where we weren't winning a lot of our work and of work we used to manufacture, and the only way to be cheaper [is to go offshore] (B).

Concluding the above topic, the main idea was that offshoring is having a negative effect on the Australian economy. Several important statements were also raised supporting the idea that overseas production or importing from overseas is not always the best solution.

#### *5.2.2.8 Theme 7: Recent Trend in Operation and Supply Chain Management in Australia*

The participant from Company I stated that the final stage of production should be as close to the market as possible. This is called 'production postponement' and helps optimise the production, logistics and costs involved. Companies H and J stated that they needed to become smarter and leaner in the supply chain to lower their inventory, while increasing their service level. Company H also stated that they were able to decrease their inventory by seven million AUD, while still increasing their service level.

The participants from Companies DM and K seemed to not have or not need knowledge of supply chain management and different production strategies. They both produced offshore; thus, neither company needed to optimise the whole operation—they only needed to ship, store and distribute. For instance, Company K stated that onshore manufacturers need larger warehouses. Company DM stated that they had to introduce disciplines into processes that were not completed well when they were manufacturing in Australia. He

stated, 'We were a bit lazy' (D). These statements are important because, after the interviews, there was an emerging question about whether Australian manufacturers have the skills and knowledge to apply different management and production strategies and different supply chain activities to sustain their operations in Australia. Of the 12 interviews, three company managers (A, H and I) were prompted to provide professional answers about supply chain strategies. Four organisations (B, F, E and J) used some production strategies, yet were unaware of supply chain strategies. Interview participants DS, DM and K did not need many production strategies because their production was already offshore, and they did not know much about the production aspect of the operation and already had basic knowledge about supply chain strategies. Company G had not much competition in the marketplace and was protected by Australian law, while Company C imported parts or semi-finished products from its US mother company and only undertook product customisation in Australia.

Regarding the question of which type of supply chain management strategies were implemented in the operation, most participants could not report specific activities, such as electronic data interchange with partners for collaborative planning, forecasting and management. Instead, they mentioned only the basic strategies:

we're always looking for new processes, new products, new ways of trying to keep our costs down. So what works for one area may not work for another area (B).

In contrast, a few of the participants were very knowledgeable in terms of supply chain and other management strategies.

Regarding information sharing with suppliers and distributors, Company I reported that they had web-based connections with distributors. This company used electronic data interchange (EDI) to communicate and share information with some of their partners. In fact, US companies must have EDI to operate with the government; thus, they must receive orders and respond via EDI. Company I also applied CPFR. They implemented these processes with a number of wholesalers; thus, they worked together in terms of demand, profile and supply chain. They also discussed how their minimum balances were going to

change and how certain factors would affect the inventory in their supply chain. Another activity they undertook was looking for bull-whip effects.

These supply chain strategies and other strategies are necessary to achieve operational excellence. These types of activities should been implemented in many Australian manufacturers' operations, yet most of them struggle in the Australian market. Sometimes manufacturers do not have the knowledge base to achieve competitive advantage. Company I also reported that, in their industry, the customer requirement is for high quality, with an affordable product. Moreover, operational excellence and effectiveness were important for them.

#### *5.2.2.9 Theme 8: Main Effect on Operation*

Concerning the 'main effect on operation', Company F stated that they had to create new and different products because they were entering a new market, which allowed them to sustain their operations. In contrast, two-thirds of the participants (A, B, DS, DM, F, E, G and J) stated that they had demand uncertainties in the market. Company B's representative stated that it is more difficult to compete in the market at the moment—financially the operation is not safe as it was before.

It's certainly a lot harder at the moment. It is not as assuring as it used to be. The areas of where, before, a lot of our companies, one division would be high and the other would be low, we would be able to move our labour around. It seems to be low all over now, rather than one picking up and one dropping, which makes it a lot harder with flexibility of your labour force, moving them around, trying to keep them employed, that sort of thing (B).

The participant from Company F stated that confidence in the market is low and consumers are not spending as much money as they used to. Therefore, one month might be good, while the next month might be bad—it is difficult to determine what will happen. Company C stated that, although their business had been in the market for 80 years, nowadays, the greatest uncertainty derives from the fact that they do not know when and where the next order will come. Company F experienced a similar problem, as quoted below:

Because we supply other Australian manufacturers, I think the demand is going down because a lot of manufacturers are closing or are importing products from overseas themselves (F).

Company E has also been struggling recently. According to the manager, they have three options: (i) close completely, which they do not want to do; (ii) become solely an importer with perhaps a small manufacturing base in Australia (keeping one or two machines and a few people); or (iii) moving the plant to Thailand and manufacturing there. They also explored undertaking a joint venture with another company. Thus, the company was considering all options to ensure they could survive. This business has operated smoothly in Australia for 98 years, and had only been struggling for the last few years. The current owner of the company is the grandnephew of the original owner; thus, the business has been passed down through family members. The family has long been committed to making fasteners in Australia; however, whether they can still achieve financial success is an unresolved question.

Company B stated that they are still receiving enough orders to keep their workforce fairly busy. However, the optimal jobs needed to keep the company turning over and making a profit are becoming harder to find, and the only way to win these jobs is by winning on price. Company J has also been encountering difficulty over the last four to five years; however, because their business has many other investments and multiple business departments, this equalises their income. Company A has also experienced difficulty with market demand. Their manager stated that sales drive manufacturing, and if sales vary, depending on many different factors, this affects the manufacturing plant and production.

In contrast to the above mentioned companies and their difficulties with market demand, Companies C and G from Sydney reported that they do not face any uncertainty in the market. These successful operations are explained by several factors. Company C's operations are protected by Australian regulations. In addition, their products are demanded by hospitals and healthcare; thus, they are not a luxury product, but a necessity. This company has the advantage of a needy market and is protected by Australian regulations. However, this is not always the case with manufacturers in Australia, most of which face

huge competition in the market and must compete against cheap imported goods and/or parts from Asia:

Why are we able to remain in Australia? Because the quality of product built overseas is not good enough in this particular kind of product. Twenty years ago, a lot of our business was export. Now a lot of the countries are making their own product—China, India, other places like that. Luckily for us, we are protected in Australia. The pressure vessel that we build is a dangerous product and the regulations in Australia block imported products from coming in, so we're protected by the regulations in Australia mainly (C).

Company G apply manufacturing postponement as they customise their product at the time when the demand occurs, this is the reason they do not face any uncertainty in the market. Further, within this topic of 'main effects in operation', Companies B, J, H, A and F stated that lead time and receiving stock on time are the major issues. All of these companies imported goods from overseas, with some importing more than others, including parts and raw materials. This is the reason for their difficulties with lead time:

Yeah, well, I think lead time is a big one because I think that if you don't have a quick lead time—the longer your lead time, the more open you are to competitive threat (H).

so quality is still seems to be pretty well the same, it's just getting the stock on time, is a major issue (B).

Companies J, H, A and F had problems with the quality of products from suppliers. Company A also stated that they had problems with supplier capability, supplier quality and ensuring supplies could meet their standards globally. This organisation was working in the automotive industry. Companies F and H stated that their most important issues were supplying quality products to their customers and delivering these quality products on time. They could manage a short lead time with parts supplied from Australia; however, if the supplier was overseas, the lead time was quite long, so they had to manage their forecasts:

So, when we get two to three months lead time on imported goods coming by boat, it's not going to be going much better than that. So obviously there are other aspects where

we can still work on—quality, to us, is of the essence, because we are selling premium-quality products, so that’s a very important criteria and it’s balancing the cost and the quality. So, making sure it’s not always about looking for the cheapest cost, but it’s also making sure we get the good quality for the money (H).

Concluding the different effects on operations, companies are encountering difficulties in their operation for different reasons because, in the changing Australian environment, they have to enter new markets, manage demand uncertainties and manage difficulties with lead time. They also struggle with quality and inventory when goods, parts or raw materials come from overseas. Further, customer demand is decreasing, with several Australian manufacturers closing or importing products from overseas. Only two of the 12 companies did not have problems with customer demand. One of the reasons for smooth operation is the competitive marketplace.

#### *5.2.2.10 Theme 9: Supply Chain Performance*

The topic of supply chain performance was separated into three sub-questions concerning inventory management, material supply and sharing information with partners. This question was not answered by all participants; however, different responses were received, which enabled good representation in the analysis.

Regarding the topic of inventory management, Company B reported that they were working under a vendor-managed inventory, which meant that most of their raw material requirements were handled by vendors. In many cases, their vendors held the raw stock and only supplied the material when Company B required it. In that case, the manufacturers hold stock and can concentrate on other core competencies, such as production and sale.

Company A also had a vendor-managed inventory. The products of Companies C and J were mainly made-to-order, and customers understood there was a longer lead time, which was still reasonable because they held the raw material stock. The offshore sites of Companies DS, DB and K arranged to supply raw material so the Australian companies did not have any influence in inventory management. The products of Companies E, H and F were made-to-stock and the companies handled all their raw material supply and inventory and finished product inventory. Company G ordered semi-finished and finished products



from the US mother company, and managed its inventory according to the sales forecast. Company I had a global operation and raw material was always supplied from the closest possible source. All their different sites around the world had their own warehouses, and, because the raw material was plasma and the finished products were mainly vaccinations, they required a cold supply chain:

If you think about our plasma products, we hold quite a bit of inventory, so we're not making to order. We produce and we hold inventory and then we supply to the end-user (I).

Regarding the idea of made-to-order or made-to-stock, only Companies C and J were the type of business where this occurred. The rest of the companies mainly distributed through retail businesses, and subsequently did not need to produce build-to-stock:

Obviously, one of our very big focus is inventory, again our main division, we make to stock, not to order, because we also play in retail. So we need to get smarter and leaner in the supply chain to lower the inventory and still increase the service level (D).

Company DM reported that they had a standard range of products, which they invested heavily in Australia. Thus, a bulk of those standard products typically would be held to three months' stock, and they implemented that all over Australia. Company DS had a similar inventory management approach, as they produced more inventory and integrated more end to end in the supply chain. Most of the companies' inventory operations were based on their raw material purchasing on historical usage or forecast information. Company K had offshore production, had a buying meeting once a month, and placed their orders every five to eight months, depending on their trends and forecasts. Most of the companies whose operations were based on built-to-stock normally held more stock than they needed to ensure retailers would have enough stock for any situation.

In contrast to this common operation style, the latest supply chain management knowledge, as presented in the literature review, raises the importance of collaborating and sharing information with suppliers and distributors on a daily or weekly basis. In addition, the literature's advice is to manufacture promptly with quick changeovers and other production strategies. Even companies who decide to go offshore have to invest much more in holding

stock, warehouse management and logistics, which could offset manufacturing efficiently and effectively closer to end-users in Australia. There exist many manufacturing and supply chain strategies to serve an efficient production base and help sustain long-term competitive advantage. Recently, successful companies have started working collaboratively with all their suppliers and distributors to share inventory information, purchasing and sale information on a daily basis to gain long-term competitive advantage.

Regarding material or product supply, Company G imported raw materials, semi-finished products and finished products from Houston, China and India. Company B imported part of their raw material from overseas, and only a small amount of finished products from overseas. However, they encountered difficulties because purchasing the raw material has become much harder than before, as explained below:

Getting raw materials from our customers nowadays is a lot harder. A lot of them are not holding the stocks here in Australia, which means when we order they then got to get it from overseas first. So that's certainly a lot harder. There's certain products we're having to hold a lot more stock ourselves, which obviously does affect our cash turnover and things like that. It is certainly getting harder because of the volumes are dropping (B).

According to Company I's representative, their biggest issue in Australia is the fact that they buy a lot of finished product in Australia, as well as producing finished products. They are a reasonably small player in the global market, and, to be competitive, they analyse supply performance and demand performance. In addition, they set minimum balances, which are appropriate based on previous performance. Although they consider minimum balances, they rarely use historical data/information; thus, they always work on the basis of a dynamic minimum balance.

Company H had a production site in Brisbane, and purchased their raw material and engineered products locally and overseas. Company F purchased some finished products from Germany and Korea. Regarding their raw materials, some came from Europe, Australia or Japan. According to the company representative, the source depended on the type of product and specifications of the product. Company E had a similar operation, purchasing raw material and some finish products locally and overseas. Companies C, B

and J obtained their raw material or parts locally and overseas, but only sold their own manufactured products in Australia. Companies DS and DM had offshore manufacturing, but also imported finished products from America, China and the Netherlands. Thus, regarding materials, parts or goods supply, the companies' activity was very similar in Australia. Most of them obtained their materials both locally and overseas.

In terms of sharing forecasting and information with suppliers and distributors, the companies' activities varied. Companies B and I manufactured efficiently and shared their forecast with their supplier each day. Company B's buyer provided a schedule for four to six months, received a despatch request virtually daily, and despatched to that request. Company I had web-based connections, such as EDI, with some of their partners, and received orders and responded via EDI. They also applied CPFR with a number of their wholesalers; thus, they worked together in terms of the demand, profile and seeing which products were selling. They also discussed how wholesalers' minimum balances could change and how this affected the inventory in the whole supply chain. They also looked for bull-whip effects to avoid unnecessarily large inventory holdings. Company I's activity is a good example of how a professional company should operate. They are a global company; however, they are not overly large, with only 1% share in the global market. However, they have their own sites on every continent to be closer to the customer, and they apply several management, production and supply chain strategies that help them be efficient and competitive.

In contrast to the above mentioned information-sharing activity, Companies G, K, F, C and J reported that they shared forecast information with their partner only a few times a year:

Well, on the customer side, we will endeavour to get forecasts of what their usage is going to be because that helps our planning, so we get forecasts where we can, but most customers can't provide forecasts. On the supplier side, we provide them annual forecasts about what we think we're going to sell obviously once a year (G).

There are certain companies where forecast sharing with partners is not essential because of product part diversification. For example, Company C ordered hundreds of different parts that came together to make one machine; thus, the supplier had little knowledge of what

occurred with the end product. Companies G, H, DS and DM shared forecast information with their partners monthly. Company B produced many products under the JIT process; thus, they had vendor-managed suppliers and shared forecast information with their suppliers and customers daily or weekly.

One of the main ideas of effective supply chain management is to share forecast information with all partners (suppliers and distributors) to avoid the huge investment in holding inventory of materials and parts of finished products. Producing effectively with an accurate inventory is one of the most important issues in manufacturing. Regardless of whether the product is suited for mass production or is a high-tech product with a defined market, production can be effective with a different strategy. One strategy is to have the vendor manage the inventory, with quick changeovers and JIT production, which requires daily forecast sharing with vendors and customers/distributors. In this case, production and inventory can be made very efficient and cost-effective. This is just one idea for an efficient operation. Different cases require different tools and activities. However, it is worthwhile using a well-known strategy that has generated success for many manufacturers around the world (Candace et al. 2011; Reichart & Holweg 2007; Singh 2015; Tarafdar 2013).

#### *5.2.2.11 Theme 10: Benefit of Onshoring*

Regarding the interview question about which type of manufacturers can stay in Australia, most participants stated that manufacturers with innovative and differentiated products with high technology are able to manufacture in Australia. The answers could be broken down into the following subthemes. The types of manufacturers that can stay onshore include manufacturers:

- with high technology who can high value add
- with customers who are able to pay higher amounts
- with a defined market strategy
- that apply high technology and are able to export
- in industries where a quick response is important
- with innovative and differentiated products
- with niche markets and premium quality

- in industries where the cost is not the only important factor—quality and other factors are also important
- with products that are difficult to ship
- that are protected by Australian regulations
- that require a flexible supply chain

Companies B, H, G and J stated that, largely, manufacturers that can keep their production onshore are those with a defined market strategy, high technology, the ability to high value add to their process, and a niche market where customers are able to pay premium. According to their view, Australian mass manufacturers with low technology are unable to compete with Asian producers:

I think there is a cost of quality, so to bring your stuff overseas, there is a cost of quality and I think a lot of, even our customers, realise that bringing stuff in from India or China, in some cases, it's not worth it because it's better to get a manufactured product locally that they know the quality is there.

Company B stated that certain manufacturers serving niche market in case when loyalty and quality are the main criteria for customers. Customers sometimes return to purchase a premium-quality product after trying a different, cheap overseas product that did not work. Thus, the confidence and quality of Australian manufacturers certainly exists.

Company I's representative stated that their business was unique and specialised. They needed highly skilled operators; thus, some of the developing nations struggled to compete in terms of quality and compliance levels. The representative stated that, if an organisation wants to be a substantial manufacturer in Australia, managers need to broaden their scope and not only think as a supplier for the Australian market. Most Australian manufacturers who have specialised and differentiated products should become global companies, and at least sell their products through distributors around the world, as implemented by Company I. Manufacturing in Australia is tough, where foreign exchange rates can be a real disadvantage; thus, companies need to be international.

However, companies in which quick customer response is important are unable to think about offshoring because they need to be close to their market:

Manufacturing in China and then ship it here takes 12 weeks. So from our business model point of view, our objective is to respond quickly to customers and have a point of difference—Australian made, we'll make it in eight days. Whereas if you get it from overseas, nothing is done in eight days; it's a different way of doing business (F).

These types of companies most likely manufacture innovative products. The features of innovative products include a short lifecycle, frequent innovation, made-to-order, unpredictable demand, short production time, short lead time and large product variety.

According to three interview participants (F, E and G) there is no reason why companies cannot manufacture in Australia if they produce innovative and differentiated products; however, those companies should also be able to export:

Yeah, things that need to be delivered quickly and that are more customised to Australia will be made in this country, and high-volume standardised products will probably be made in Asia, and that's mostly because obviously the labour's cheaper and the raw materials are cheaper (F).

Further, Company E's manager pointed out that many experts around the country and industry initiatives think that Australia could become an R&D country. However, manufacturers know that R&D needs to be close to the manufacturing site because every new invention needs to be tested:

the world seems to be a little bit smaller nowadays in terms of communication and transport. Definitely the inventors—everyone keeps talking about the inventors and we need to reinvent things and spend money on R&D and Australia could become the R&D centre of the world. That's fine—this is only my opinion now—I think it's fine to be able to invent and to research and develop high-end products, but there still has to be a need to make it as well (E).

There were some other responses to the question about which types of manufacturers can stay in Australia. Company K stated that organisations that need available stock to react quickly need to manufacture closer to the market. Companies I and G stated that not only cost, but also quality and other factors are important:

I think where people can fail is that they might get carried away with a model where they just look at the cost of the product and they don't look at the overall cost of the supply chain (I).

Other respondents stated that organisations with products that are difficult to ship stay in Australia (stated by Company DS); organisations or sectors with products protected by Australian regulations are able to stay in the country (stated by Company C); and companies that require flexible supply chains, have uncertainty in demand, can produce in Australia (stated by Company DS):

No, not necessarily niche markets, but niche markets are helpful for that purpose. But I think even in mass markets, to engineer out the labour and the conversion costs and still—provided you have the right marketing conditions—that's just the requirements for flexibility in supply, uncertainty of demand and an ugly product, i.e. it's hard to shift. It could all lend to good reasons why you would onshore manufacture (DS).

This section of the analysis has presented numerous quotations to highlight the managers' own words about the reasons for producing within the Australian border. Even the interview participants whose companies were recently struggling to survive in Australia had important comments and ideas about Australian manufacturing activity as a common practice, how to lead companies towards long-term success and which activities to avoid.

### **5.3 Correlation between Product Type and Operation**

After reviewing the findings of the analysis and focusing on the different types of manufacturers, their site locations and their inventory management systems, an idea emerged—whether there is any correlation between product type (functional or innovative), inventory management (built-to-stock or built-to-order) and site location (onshore or offshore). According to Fisher (1997), Hull (2010) and Elliott and Percy (2007), functional products are generally built-to-stock and innovative products are generally built-to-order. These features did not separate clearly among the interview participants, with some manufacturers who built-to-stock, some who built-to-order, and some who implemented both inventory management systems. Reviewing the full sets of data, there were

manufacturers with innovative and functional products with built-to-order or built-to-stock, and organisations that chose to remain within the Australian border or go offshore.

**Correlation between type of product and operation**

**Product built-to-stock or built-to-order**

<b>Onshore or offshore operation</b>	<b>Onshore</b>	Built-to-stock onshore  <b>3 organisations</b> (Companies E, I, F)	Both built-to-order and built-to-stock onshore  <b>2 organisations</b> (Companies B, H)	Built-to-order onshore  <b>3 organisations</b> (Companies J, C, G)
	<b>Offshore</b>	Built-to-stock offshore  <b>4 organisations</b> (Companies DM, DS, K, A)	Both built-to-order and built-to-stock offshore  <b>None</b>	Built-to-order offshore  <b>None</b>

**Figure 0.2: Correlation between Type of Product and Onshore or Offshore Operation**

To incorporate the views of Fisher (1997), Hull (2010) and Elliott and Percy (2007) in this data analysis, Figure 5.2 demonstrates that companies operating within the border are able to operate both built-to-stock and built-to-order products, while offshore organisations do not generally favour producing innovative products, which are preferably built-to-order. The theoretical framework, findings and above table support the view that organisations with innovative products are advised to remain closer to the end-user. This view provides an answer to the main research question. The findings also answer the first research sub-question: what is the trend among Australian manufacturers regarding local sourcing and local manufacturing strategies? The result indicates that two-thirds of the randomly selected interview participants maintained production within the border, while one-third were offshore manufacturers.

## 5.4 Summary

This study demonstrates that commodity manufacturers generally go offshore primarily to save costs. Meanwhile, a large portion of Australian manufacturers do not apply or only



partly apply supply chain management (Theme 10), even though these activities could help with efficiency and reduce costs. Sometimes this background of negligence derived from a lack of knowledge (Theme 8). Without knowledge of the ways to manage the entire supply chain effectively, an organisation may lose the ability to gain long-term competitive advantage.

Going offshore sometimes creates a problem with serving customers on time, unless companies maintain large inventory stores, which can require huge investment in warehousing, logistics and ensuring the stock level is always accessible (Theme 7). When manufacturing overseas with a longer lead time, companies are more open to competitive threats, as well as risks deriving from the fact that they cannot measure and prepare for all potential situations. Further, offshore operation does not support the Australian workforce and economy, and can force other companies to go offshore (Theme 7). The results also indicate that there is a lack of investment in the Australian manufacturing sector. In terms of onshore manufacturing, companies with high technology who can high value add, and manufacturers with a defined market strategy can effectively operate in Australia; however, the optimal combination is to produce for the Australian market and to export (Theme 11). In industries where a quick response is important, manufacturers should remain close to the market, apply flexible supply chain management and produce cost-effectively in Australia (Theme 11).

Highlighting the main message of these findings, the majority of manufacturers in Australia do not maintain a suitable supply chain system; thus, most of them focus on their core company. Manufacturers need to work in a supply chain system, apply daily information sharing about customer demand from the supplier's supplier to the retailer, and maintain efficient forecasting (Theme 10). Australian manufacturers apply agility, but not to the extent possible and generally not throughout the whole supply chain (Theme 3). Additionally, to sustain their operation in a rapidly changing environment, manufacturers should frequently reassess their resources and capabilities and rethink their organisational, market or product strategies (Theme 9). The recent trend in offshore manufacturing highlights the awareness of the hidden, unexpected and other unforeseen costs of offshore

operations (Theme 7). Australian manufacturers—especially those with specialised products—should enter foreign markets to ensure different sources of income (Theme 11).

## Chapter 6: Survey Analysis

### 6.1 Introduction

This chapter describes the analytical approach of the online survey, thereby confirming the interview results, outlining how the interview analysis influenced the survey development, and explaining how the survey questions were established. In addition, this chapter outlines the data analysis process and methods, and highlights the similarities and differences between the different analysis parts of the study. The main findings/themes from the interviews (see Table 5.1 interview result table) provided the topics and background to create the survey questions. The questionnaire was purposely designed to be short, concentrating only on the main concepts and themes from the interview data. Table 6.1 details the established themes and result of the online survey.

**Table 6.1: Established Themes and Result of the Online Survey**

Established themes	Online survey result — Analysed by Qualtrics
Number of employees	Most participants were from small or medium-sized companies.
Site location	71.1% of the survey participants have the production site in Australia
Offshoring Reasons	Production moving overseas because of price competition
Flexibility and Agility	It is important, organisations apply agility and flexibility but most manufacturers applied flexibility and agility only to their core company, and did not extend it to the whole supply chain.
Management Strategies / Lack of successful operation and supply chain strategies	Applied operation strategies are not focusing on advanced supply chain management techniques Australian manufacturers are following the trend to move offshore, instead of trying to apply successful operation, management or supply chain strategies
Negative Effects of Offshoring	Difficulties with demand uncertainties and lead time from overseas
Recent trend in Operation and Supply Chain Management	Sharing demand and forecast information is important, yet did not apply this practice to the extent possible.
Demand uncertainty, difficulties with lead time	Demand uncertainty, lead time. Difficulties with quality and inventory when goods, parts or raw materials come from overseas
Proportion of raw materials or finished product from imported from overseas	Materials and parts supply is mainly from overseas, huge inventory, long lead time

Product type and geographical distance of production	Most of the manufacturers remained in Australia are innovative product manufacturers. More than 70% of respondents have their manufacturing site in Australia
Lacking TCO calculation	Organisations do not calculate invisible, hidden and unexpected costs when moving offshore
Type of product are manufactured	Mass production overseas; customised production in Australia
Not enough investment	Manufacturers and/or government are not investing enough in manufacturing sector
Australian Unions drives prices high	Australian unions drive prices and costs too high to be able to compete in the market
Australia needs affordable energy	Australia's competitive edge is based on an affordable and reliable energy supply

For the purpose of validating the interview results, a survey was conducted during the second phase of data collection. After examining the outcomes and interpreting the interview results, the survey questions were established purposely targeting to re-question the main concepts and themes of the interview results. The questionnaire used a four-point Likert scale because, after reviewing several different Likert scale survey samples, four points seemed appropriate as a measuring scale. Most questions included the scale 'strongly agree', 'agree', 'disagree' and 'strongly disagree'; however, a few questions were shaped differently, as presented in Appendix IX. However, as revealed by the analysis of the online survey, a 'not applicable' scale should have been added to some questions.

The next section presents the online survey analysis.

## **6.2 Analytical Approach of First Part of Questionnaire—Demographic Questions**

This part of the analysis presents the details of the demographic data from the online survey, such as the participants' industry type; the manufacturers' number of employees; the geographical location of the manufacturing site; whether the firm was a mass manufacturer or innovative product manufacturer; and the proportion of raw materials, parts or finished products that the participants' organisations sourced from overseas.

### 6.2.1 ‘How Large is Your Company? (Number of Employees)’

As Table 6.1 shows, 74.44% of the participants were from small companies with less than 50 employees, while 10 medium, seven big and six large companies participated in the online survey. Compared with the interview participants, there was a similar proportion of small and large organisations.

**Table 0.2: Proportion of Small and Large Companies among the Participants**

#	No. of Employees	%	Count
1	1 to 49 (small size companies)	74.44	67
2	50 to 199 (medium size companies)	11.11	10
3	200 to 999 (big size companies)	7.78	7
4	1,000 to 10,000 (large size companies)	6.67	6
<b>Total</b>		100	90

### 6.2.2 ‘Please Specify the Location of Your Manufacturing Site/s (You can Select More than One Answer)’

This question was used to identify the location of the manufacturing site. As Table 6.3 indicates, 71.07% of the participants were producing in Australia. Further, 14 manufacturers had a site location in Asia, nine in Europe, six in North America, three in South America and three in Africa.

**Table 0.3: Location of Manufacturing Sites**

#	Location	%	Count
1	Australia	71.07	86
2	Asia	11.57	14
3	Europe	7.44	9
4	North America	4.96	6
5	South America	2.48	3
6	Africa	2.48	3

The interview results indicated that 58.8% of the participants had a production site in Australia. The difference between these two results may have derived from the participant number/sample size of the two data collections. The survey represented a larger source of data (119) with a wider range of variance, while the number of interviews conducted (12) had limited variation. It should be noted that this question allowed multiple choices, so participants could choose more than one answer.

### **6.3 Analytical Approach of Second Part of Questionnaire—The Operation and Product Type**

The next questions focused on whether the organisation was a mass manufacturer or innovative product manufacturer. As confirmed by the responses to this question, more than 80% of the respondents were innovative product manufacturers. The answer also indicated that there are more innovative product manufacturers than mass manufacturers in Australia. It would be interesting to see the same survey 50 years ago, as the results may have shown much more mass manufacturing than today. Although this question was not asked, it is likely that several mass manufacturers have since moved their production to Asia.

#### **6.3.1 ‘The Products of my Company Are Complex, Allowing Many Variations in the Finished Product, and Customer Demand is Unpredictable’**

**Table 0.4: Proportion of Innovative and Mass Manufacturers Operating in Australia**

#	Answer	%	Count
1	Yes	83.53	71
2	No	16.47	14
	Total	100	85

To ensure that the survey respondents understood the above question, the reverse question was also asked—whether they were mass manufacturers. This provided prompt validation of the first question regarding the proportion of innovative and mass manufacturers.

#### **6.3.2 ‘My Organisation is a Mass Manufacturer with Standard Products (Products without Significant Elements of Customisation)’**

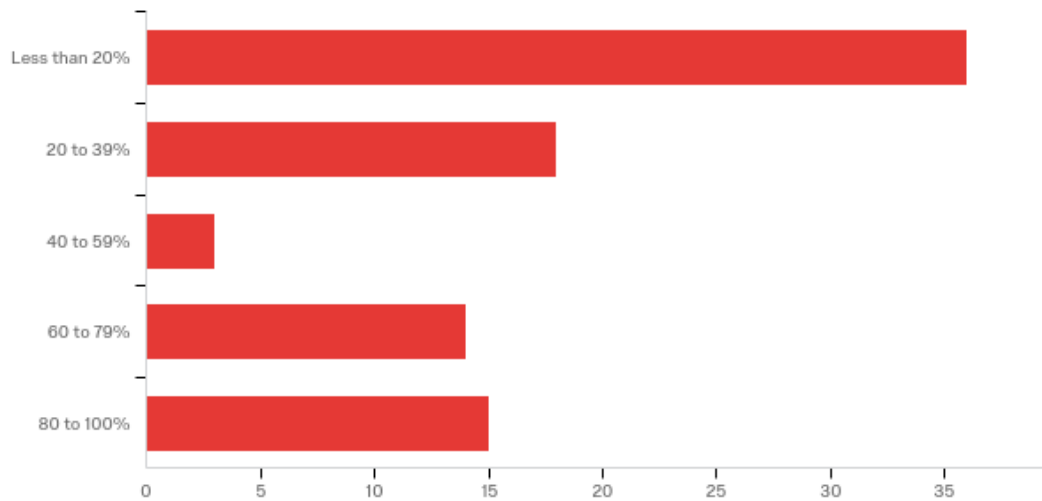
**Table 0.5: Proportion of Mass Manufacturers and Innovative Product Manufacturers**

#	Answer	%	Count
1	Yes	23.53	20
2	No	76.47	65
	Total	100	85

The results indicated similar proportions in both questions (Tables 6.4 and 6.5) in regard to participant product and operation type, which validated the first question's result: 23.53% of the participants stated that they were mass manufacturers, while 76.47% of the participants indicated that they were not, which means they were probably producing innovative products with many variations in the finished product and a short lifecycle. These two questions also validated the literature review and theoretical framework because it seems that many more mass manufacturers than innovative manufacturers have decided to move offshore; thus, it is more beneficial for innovative manufacturers to produce closer to the end-user (Fantazy et al., 2009, Kim and Chai, 2017).

### **6.3.3 'Proportion of Raw Materials, Parts or Finished Products that My Organisation Sources from Overseas'**

The response to the next question indicated that 41.86% of the survey participants purchased their raw materials or parts mainly from Australian suppliers, while one-third of the companies sourced their raw materials and parts mainly from overseas. This question was also important to evaluate the type of operation of the Australian manufacturers, and explore the correlation (if any) with the literature and theoretical framework. As stated in the literature, production and supply chains involve less cost and lead time and can be more efficient and responsive if the source of the materials or parts for production is closer to the site (Minter 2009; Anonymous 2013; Hartman et al. 2017). In terms of sourcing for production, distance has a similar negative effect on responsiveness and effectiveness than on manufacturing (Stanczyk et al. 2017; Vos et al. 2016) .



**Figure 0.9: Proportion of Raw Materials, Parts or Finished Products Sourced from Overseas**

## **6.4 Analytical Approach of Third Part of Questionnaire—Topic Questions**

As aforementioned, the next 12 questions had the same Likert-type scale; thus, those questions were included in one table to be able to finalise them in a short amount of time. As an introduction to this part of the research, the following question led participants to the Likert-type scale of question:

Please indicate the extent to which you agree or disagree with the following statements as they apply to your organisation.

### **6.4.1 Looking Beyond the Numbers of the ‘Topic Questions’**

The first question of the main part of the survey asked whether organisations see the importance of sharing demand and forecast information weekly or daily.



**Table 0.6: Importance of Sharing Forecast Information with Partners**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
1	Sharing demand and forecast information with suppliers and distributors weekly or daily is important	10.00%	8	56.25%	45	27.50%	22	6.25%	5	80

As Table 6.6 illustrates, more than the half (56.25%) of the respondents indicated that sharing demand and forecast information with suppliers and distributors weekly or daily is important. This proportion is a slight contrast to the interview result, as most of the interview participants applied monthly or quarterly forecast sharing. However, the questions in the interviews and surveys were slightly different, with the interview question focusing on operational practice and the survey requesting information about the importance of weekly or daily forecast sharing. Perhaps the executives were aware of the importance of daily or weekly forecast sharing, yet did not apply this practice to the extent possible.

The academic literature mostly provides advice for best practice regarding demand information sharing (Kembro & Selviaridis 2015; Kim & Chai 2017), which practice in some cases cannot be achieved because of the nature of the particular business. Several manufacturers around the world operate with huge warehouse and inventory costs to assure secure stock. Further, the theoretical framework (Section 3.5) included the DC concept, which suggested that ‘certain manufacturers should be able to integrate, build and reconfigure internal and external competences to promptly react to changing environment’, which includes the application of regular (daily or weekly) demand information sharing.

The next question focused on demand uncertainty. As Table 6.7 demonstrates, most participants had demand uncertainty in the market, with 62.19% survey participants agreeing and 18.29% strongly agreeing that they had uncertainty in the marketplace.

**Table 0.7: Demand Uncertainty**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
2	My organisation is experiencing demand uncertainty in the market	18.29%	15	62.19%	51	17.07%	14	2.44%	2	82

This outcome is very similar to the interview result, which showed that Australian manufacturers have been recently experiencing an unstable business environment. The literature explores several actions to react to a volatile business environment (Georgiadis et al. 2011; Merschmann & Thonemann 2011) and demand uncertainty, which was also highlighted in the theoretical framework as an environmental perspective that requires prompt reaction.

The following question focused on difficulties with lead time and transportation.

**Table 0.8: Difficulties with Lead Time**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
3	My organisation has transportation and lead time problems when we source raw materials and/or finished goods from overseas	14.10%	11	38.46%	30	38.46%	30	8.97%	7	78

Table 6.8 illustrates that slightly more than 50% of the Australian manufacturers had difficulties with transportation and lead time when they sourced raw materials and finished goods from overseas. The same number of survey participants agreed and disagreed (38.46%) with this question. This result is slightly different to the interview result, as around 65% of the interview participants complained about lead time uncertainties, while only 52.56% of the survey participants mentioned the same statement. Several studies have investigated the lead time difficulties of overseas supply or production (Hannon 2009; Holweg et al. 2011; Kazmer 2014; Stanczyk et al. 2017). The theoretical framework also emphasised the ‘ideal adoption of management and operational strategies’, including

reducing the lead time of material and parts supply, as well as reducing lead time to customers.

The next question asked which types of Australian manufacturers are able to stay in the border. The fourth question specified the answer as having a niche market, and the fifth question targeted the correlation between smooth operation and applying flexibility.

**Table 0.9: Niche Market**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
4	My organisation is able to produce in Australia because we have a niche market in Australia	20.99%	17	50.62%	41	23.45%	19	4.94%	4	81

Table 6.9 indicates that 71.61% (20.99% + 50.62%) of the participants believed they were able to produce in Australia because they had a niche market. The interviews showed a similar result, with a somewhat smaller proportion of the organisations indicating their niche market as the reason they were able to manufacture within the border.

**Table 0.10: Applying Flexibility and Agility in Everyday Activity**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
5	My organisation is able to remain in Australia because we apply flexibility and agility in our everyday activity	31.25%	25	62.50%	50	5.00%	4	1.25%	1	80

Table 6.10 shows that 93.75% of the participants strongly agreed or agreed that applying flexibility and agility to their everyday activity was important. The interview results showed similar figures; however, the interview results also showed that most manufacturers applied flexibility and agility only to their core company, and did not extend it to the whole supply chain. The survey question did not specify the whole supply chain; thus, in this instance, only core companies' activities and responses can be compared.

A previous result indicated that more than 80% of the participants in the online survey were innovative product manufacturers. The above result indicates that a high number of participants applied agility and flexibility in their everyday activity, which complies with the theoretical framework and several studies from the literature (Ismail & Sharifi 2006; Liu et al. 2010; Malakouti et al. 2017; Vazquez-Bustelo et al. 2007; Gunusekaran et al. 1999; Zhang 2011). This result also provides strong support for the main research question, and fulfils the whole theoretical framework.

The next two questions focused on the reasons that certain manufacturers move offshore. Question 6 in Table 6.11 concentrated on the price and cost of manufacturing.

**Table 0.11: Moved Offshore for Cost Savings**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
6	The production of my company moved overseas because of price competition	5.20%	4	12.99%	10	35.06%	27	46.75%	36	77

Table 6.11 presents an interesting response, as 46.75% strongly disagreed and 35.06% disagreed that their organisation had chosen or would choose to move overseas because of price competition. According to the respondents' answers, price and cost are not the decision-making factors when considering moving production offshore.

As stated by a few participants in the comment section, this question may have required a 'not applicable' choice of response. The results indicated that a few respondents did not answer this question or may have answered based on assumption, especially for those who produced in Australia. This result shows similar yet slight variation compared with the interviews, thereby highlighting that there is an offshoring trend among Australian manufacturers, yet still a high number staying in Australia and not being willing to relocate for price reduction purposes. Interestingly, the interview results showed slightly different figures, with most interview participants mentioning operational and product costs as an important factor, yet only 25% of the interview participants had moved offshore to reduce costs, and all were mass manufacturers.

The next question also related to the group of questions regarding why manufacturers decide to move production overseas. Table 6.12 shows that most of the respondents disagreed (38.16% disagreed and 51.37% strongly disagreed) that they had moved or would move production offshore because of entering different markets.

**Table 0.12: Entering Different Markets**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
7	The production of my company moved overseas because we entered a different market overseas	2.63%	2	7.84%	6	38.16%	29	51.37%	39	76

The result showed that entering a different market was not an important factor among Australian manufacturers. This figure represents the same view as the interview results.

As Table 6.13 describes, the following question focused on the lack of calculating unexpected, hidden and invisible costs. The result indicated that most of the participants agreed (61.04% agreed and 16.88% strongly disagreed—total of 77.02%) that most manufacturers who move offshore are unaware of the unexpected, hidden and invisible costs of offshore operation. The interviews indicated a similar result.

**Table 0.13: Manufacturers Unaware of the Unexpected, Hidden and Invisible Costs of Offshore Operations**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
8	Although several Australian manufacturers are following the trend to move offshore, many do not calculate the unexpected, hidden and invisible costs of offshore operation	16.88%	13	61.04%	47	18.18%	14	3.40%	3	77

Question 8 focused on the number of manufacturers unaware of the unexpected, hidden and invisible costs of offshore operations. According to Table 6.13, almost two-thirds of the

participants agreed or strongly agreed that Australian manufacturers are following the trend to move offshore, yet do not calculate the unexpected, hidden and invisible costs of offshore operations to the extent possible.

**Table 0.14: Lack of Successful Operation and Supply Chain Strategies**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
9	Australian manufacturers are following the trend to move offshore instead of trying to apply successful operation, management or supply chain strategies	12.82%	10	51.28%	40	32.05%	25	3.85%	3	78

The results in Table 6.14 are very similar to the interview results because, out of the 12 interviewees, many applied different operation or supply chain strategies, yet only four had extensive knowledge and applied various supply chain and operation techniques, not only to their core company, but also throughout their partners (suppliers and distributors).

Question 10 focused on investment in asset and knowledge building among Australian manufacturers. As Table 6.15 shows, more than two-thirds of the survey participants agreed or strongly agreed that manufacturers in Australian are not investing enough in their asset and knowledge base.

**Table 0.15: Investment in Assets and Knowledge**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
10	Manufacturers in Australia are not investing enough in asset and knowledge building	15.58%	12	53.25%	41	27.27%	21	3.90%	3	77

The findings of the interview results showed a naturally emerging theme—not in response to a direct question—that manufacturers and the government do not invest enough in the

manufacturing sector. The results of the two extra survey questions indicated the importance of this topic and showed similar results to the interviews.

Question 11 was similar to the previous question, except it focused on government investment in the Australian manufacturing sector. As Table 6.16 describes, 92.31% of the participants agreed or strongly agreed that the Australian Government was not investing enough in the manufacturing sector. This result also confirmed the views of the interview participants.

**Table 0.16: Government Investment in Australian Manufacturing Sector**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
11	There is a lack of investment from the government into Australian manufacturing	47.44%	37	44.87%	35	7.69%	6	0.00%	0	78

The last question in this section focused on the two main product types, and the geographical distance in terms of producing them. According to Table 6.16, 87.34% of the survey respondents agreed or strongly agreed that it is sometimes beneficial for mass manufacturers to move production to low-cost countries; however, innovative products that are much more customised and require a quick reaction for changing market demands can be more effectively produced locally. This result is very similar to the interview result and confirms the findings of the literature review (Fantazy et al. 2009; Hartman et al. 2017; Kim and Chai 2017).

**Table 0.17: Product Types and Geographical Distance of Production**

#	Question	Strongly agree		Agree		Disagree		Strongly disagree		Total respondents
12	Standard products that are produced in large number (bulky goods, mass production) can be produced more effectively in Asia, yet products that are more customised and need to be delivered quickly can be more effectively produced locally	35.44%	28	51.90%	41	10.13%	8	2.53%	2	79

This result shows another important reflection of the theoretical framework, as the framework proposed correlations between the product type and the optimal geographical distance to produce. For example, the framework suggested that innovative products with many variations in the finished product would ideally be produced closer to the end-user, especially in a volatile business environment.

## **6.5 Summary of Comments Part of Survey**

After the multiple choice section of the survey, the last request was for the participants to provide any further comments. The comments section provided many valuable answers that were collected into different topic groups, as follows: (i) refused to move to Asia, but not easy to produce in Australia; (ii) need more government action and private investors in manufacturing sector; (iii) strong Australian unions make costs and prices uncompetitive; (v) expensive energy; and (v) offshore does not work in the long term. These themes are detailed below.

### **6.5.1 Refused to Move to Asia, but Not Easy to Produce in Australia**

There was a trend among Australian manufacturers to move production offshore; however, according to the survey results, most (more than 70% of participants) were still able to produce within the border. The following comments describe the view of this topic and the difficult issues recently experienced by Australian manufacturers:



Our company has refused to manufacture in China and overseas to date, unlike a lot of other Australian companies have. We are and have been working very hard to keep the manufacturing here in Australia but it is getting harder and is difficult to see how long we can keep this going due to pricing from our competitors.

Since the announcement of the closure of the automotive industry in Australia, the focus has been on winding down, compensating and re-training the industry to exit gracefully.

As stated above, manufacturers in Australia are experiencing difficulty because of the costs of operation and the fact that most manufacturers are not competitive, compared with overseas suppliers.

This finding is interchangeable with the findings of the first phase of data collection (interview); thus, producing in Australia can be challenging. Governmental reports and the limited number of academic papers targeting the Australian manufacturing sector have presented the same view (ABS 2017; AFR 2013; Beer 2004; DIIS 2015; Fayezi et al. 2015; Green 2017). As the theoretical framework suggested, innovative product manufacturers with a close supply, close production to the end-user and implementation of an agile and responsive supply chain and dynamic strategy changes would be able to achieve long-term competitive advantage; however, not all Australian manufacturers apply DC or an agile supply chain to their operations. Further, manufacturing near to the end-user is only ‘one side of the coin’—manufacturers should also manage their supply from close distance to ensure the viability of the responsive supply chain viable (Steinle 2008; Tunisini et al. 2011).

#### **6.5.2 Need More Governmental Action and Private Investors in Manufacturing Sector**

The comments section of the questionnaire was overwhelmed by critical opinions about the lack of governmental investment or assistance in the manufacturing sector. Further, one of the participants stated that private investors and the government need to keep reinvesting in new workplace technology and equipment, and to keep up with overseas competition. Other opinions were as follows:

The government needs to back Australian business more. Too many government regulations are making hard for Australian business to compete with overseas business.

Government needs to invest more into local small business manufacturing. Even though we purchase 95% of our parts thru [sic] local suppliers, those suppliers have to import these components from overseas, as Australia does not manufacture electronic components AT ALL. A 'Silicone Valley' would be a good start.

According to another survey respondent, the respondent's manufacturer had worked extremely hard to break into supply chains overseas, with very little government assistance. He stated that greater assistance should be directed towards the companies that have survived:

Whilst the government supports large manufacturers they do not invest or support small to medium manufacturers. It is disappointing to see millions invested to support these manufacturers who have now decided to close plants and move all manufacturing offshore. It is equally disappointing that there is little support from government to buy locally manufactured products for government tenders and other investment opportunities ... I can see why others have gone overseas and I feel that our Government has let manufacturing industries down with numerous decisions made for our country and I am old school and would rather look after our own first although it is getting harder all the time.

As the results indicated, many Australian manufacturers need governmental assistant to survive or operate effectively in Australia. The literature has a very limited view about the need for governmental and private action and investment in the Australian manufacturing sector (DIISRTE 2012). The next section discusses the negative effect of the recent business environment.

### **6.5.3 Strong Australian Unions Cause Uncompetitive Costs and Prices**

The interview responds did not appoint, but questionnaire comments arise new finding that strong Australian unions drive costs too high for manufacturers to be able to compete in the market. The following statements describe some of the participants' opinions about unions:

The reason that enterprises move overseas is because they fear the power of the unions, now and in the future.

As a manufacturer I see Australia wages influenced by our strong economy and unionised wages system has made us slowly become an uncompetitive manufacturing environment in the new fast moving global marketplace that cares not about regions but bottom line production costs to compete against rivals elsewhere.

The fact that two independent respondents discussed unions and their disadvantageous effect on price indicates that this is a real concern in Australia and has a negative influence on Australian manufacturers. It would be beneficial for the government to examine this problem.

#### **6.5.4 Expensive Energy**

As stated by a survey participant, Australia and Australian manufacturers need competitive energy prices to survive:

Australia's competitive edge is based around affordable and reliable energy supply. Successive governments have completely dropped the ball on this. I can't print what I really would like to say.

The energy price in the manufacturing sector as a theme did not arise in the previous results, yet is an important area for government consideration.

#### **6.5.5 Long-term Considerations**

Among many other important notes and comments, two respondents raised an important issue regarding the interests of future generations:

moving manufacturing off shore can only have short term benefits for a few, but will have a long term impact on how our society works as per the various revolutions when the shift of wealth is too great.

The second respondent stated sarcastically:

Once manufacturing is killed off in Australia we can really become the clever country!

The union and energy problems did not emerge in the previous analysis, yet long-term issues with offshoring provide a considerable topic of interest for the government.

## **6.6 Summary**

The online survey targeted results that had direct correlation with the research questions, literature and/or theoretical framework. A rigorous analysis was achieved through application of the hermeneutic cycle (Klein & Myers 1999; Myers 1997), as presented in Chapter 7.

More than 80% of the respondents worked for innovative product manufacturers, in which the products were complex and allowed for many variations in the finished product, and the customer demand was unpredictable. This confirms the theoretical framework and the literature, which proposes that innovative product manufacturers should remain closer to the end-user. Moreover, 87.34% of the survey respondents agreed or strongly agreed that it is sometimes beneficial for mass manufacturers to move production to low-cost countries. However, innovative products that are more customised and require quick reactions to changing market demand can be more effectively produced locally, which confirms the theoretical framework and the literature (Lo & Power 2010; Fisher 1997).

In addition, 93.75% of the participants strongly agreed or agreed that applying flexibility and agility to everyday activity is important. The interview results showed similar figures; however, the interview results also indicated that most manufacturers applied flexibility and agility only to their core company and did not extend it to the whole supply chain. This result aligns with the theoretical framework, which suggests using an agile supply chain solution for efficient and responsive production. The result also answered the main research question. Thus, an agile supply chain can help innovative product manufacturers produce closer to the end-user, as confirmed by the literature.

Regarding Australian price and costs compared with Asian production, there was an interesting response rate among the survey participants that illustrated that more than 80% of the respondents disagreed that their company had moved or would move overseas because of price competition. In terms of the main research question, the literature and the

theoretical framework, the above findings provided the expected result—that an agile supply chain is able to help create innovative products closer to the end-user. The next chapter presents a discussion of these results.

## **Chapter 7: Discussion**

### **7.1 Introduction**

This chapter presents the discussion of the research findings and their implications, based around the theoretical framework that helped frame the analysis component of this study (Chapters 5 and 6). The main objective of this chapter is to provide a summary of the findings that emerged from a complex evaluation of the data, the research questions, the theoretical framework and the literature. It is an accumulation of the analysis performed and literature examined to assist in explaining the collected data to answer the research question and sub-questions. After applying this process, the researcher was able to demonstrate the key contributions of this study, which also revealed other key areas for which this framework will have implications. This chapter has the following structure: Section 7.1 is the introduction; Section 7.2 discusses the correlation between the research question, theories and results; and Section 7.3 presents the chapter summary.

Table 7.1 presents all the main themes and patterns established in the analysis phase of the research. Although the interview analysis was more in-depth than the online survey analysis, the main themes were very similar in both analyses. Table 7.1 summarises the differences and similarities between the themes in the qualitative and quantitative analyses.

**Table 0.5: Comparison Between Interview and Survey Result**

<b>Established themes in the interview study</b>	<b>Interview study result — analysed by NVivo</b>	<b>Interview result validated by the survey study /Established themes</b>	<b>Online survey result — Analysed by Qualtrics</b>
Number of employees	Most participants were from small or medium-sized companies.	Number of employees	Most participants were from small or medium-sized companies.
Site location	58.8% of the interview participants have the production site in Australia	Site location	71.1% of the interview participants have the production site in Australia
Offshoring Reasons	Production moving overseas because of price competition	Offshoring Reasons	Production moving overseas because of price competition
Flexibility and Agility	It is important, organisations apply agility and flexibility but mainly for their core company. Most of them do not apply supply chain techniques, thus they don't optimise the information and good flow throughout their supplier and distributors	Flexibility and Agility	It is important, organisations apply agility and flexibility but most manufacturers applied flexibility and agility only to their core company, and did not extend it to the whole supply chain.
Management Strategies	Applied operation strategies are not focusing on advanced supply chain management techniques Australian manufacturers are following the trend to move offshore, instead of trying to apply successful operation, management or supply chain strategies	Management Strategies / Lack of successful operation and supply chain strategies	Applied operation strategies are not focusing on advanced supply chain management techniques Australian manufacturers are following the trend to move offshore, instead of trying to apply successful operation, management or supply chain strategies
Negative Effects of Offshoring	Negative effect on the Australian economy Difficulties with transportation and lead time from overseas	Negative Effects of Offshoring	Difficulties with demand uncertainties and lead time from overseas
Recent trend in Operation and Supply Chain Management	Sharing demand and forecast information is not frequent enough. Advanced supply chain techniques are applied only by large manufacturers	Recent trend in Operation and Supply Chain Management	Sharing demand and forecast information is important, yet did not apply this practice to the extent possible.
Main Effect on Operation	Demand uncertainty, lead time. Difficulties with quality and inventory when goods, parts or raw materials come	Demand uncertainty, difficulties with lead time	Demand uncertainty, lead time. Difficulties with quality and inventory when goods, parts or raw materials come from overseas

	from overseas		
Supply Chain Performance	Materials and parts supply is mainly from overseas, huge inventory, long lead time	Proportion of raw materials or finished product from imported from overseas	Materials and parts supply is mainly from overseas, huge inventory, long lead time
Benefit of Onshoring	Certain manufacturers are able to operate in Australia, such as 1) manufacturers with high technology who can high value add (innovative product manufacturers); 2) with a defined market strategy; 3) that apply high technology and are able to export; 4) in industries where a quick response is important; 5) applying agility and flexibility in everyday activities	Product type and geographical distance of production	Most of the manufacturers remained in Australia are innovative product manufacturers. More than 70% of respondents have their manufacturing site in Australia
Lacking TCO calculation	Organisations do not calculate invisible, hidden and unexpected costs when moving offshore	Lacking TCO calculation	Organisations do not calculate invisible, hidden and unexpected costs when moving offshore
What type of manufacturer can stay in Australia	Mass production overseas; customised production in Australia	Type of product are manufactured	Mass production overseas; customised production in Australia
Not enough investment in manufacturing sector	Manufacturers and/or government are not investing enough in manufacturing sector	Not enough investment	Manufacturers and/or government are not investing enough in manufacturing sector
		Australian Unions drives prices high	Australian unions drive prices and costs too high to be able to compete in the market
		Australia needs affordable energy	Australia's competitive edge is based on an affordable and reliable energy supply

As Table 7.1 shows, the main themes and the result in both analyses of the study were very similar, except the online survey comment section established another two emerging ideas—that Australian unions drive prices too high and Australia's competitive edge is based on an affordable energy supply. Both analyses established more concepts, themes and sub-nodes (specified below); however, this table includes only the specific themes that



were connected to the theoretical framework, literature and research questions. This comparative table also presents how the established themes in the qualitative and quantitative sections supported each other. Any extra themes that were relevant, yet did not directly answer the research questions, were not included in the main analysis. These themes are presented as follows: company profile, manager position, important factors when determining plant location, innovation frequency, lean management, JIT, quick changeover, integrated sales and operation plan, online-based information sharing, and materials from Australia are usually premium.

Applying a sequential exploratory strategy (Creswell 2009) that reflected building the quantitative data collection based on the findings of the qualitative analysis provided the ability to validate the preliminary results. Following Creswell's (2009) concept, the online questionnaire was established based on the interview results. As Table 7.2 highlights, most of the findings of the online survey confirmed the findings of the interviews.

**Table 7.2 Similarities and Differences between Interview and Survey Results**

<b>Main themes from survey validating main themes from interviews</b>	<b>Similarities and differences between interview and survey results</b>
Number of employees	Similar result, with slight difference because of the different sample size. Both interview and survey results showed that most participants were from small or medium-sized companies.
Site location	Similar result, with slight difference because of the different sample size. In terms of the number of manufacturers with a site location in Australia, the interview results showed 58.8%, while the survey results showed 71.1%.
Proportion of innovative and mass manufacturers staying in Australia	Similar result. Both interview and survey results highlighted that many more mass manufacturers than innovative manufacturers have decided to move offshore.
Proportion of onshore and offshore sourcing	Similar result, with 40 to 50% of participants purchasing their materials or parts mainly from Australian suppliers. An interesting result is that all participants sourced smaller or larger amounts of their materials or parts from overseas.
Importance of sharing forecast information with partners	The survey results showed a slight contrast to the interview results, as most of the interview participants applied monthly or quarterly forecast sharing. However, the questions in the interviews and surveys were slightly different, which may have caused the variation in result.
Demand uncertainty	Similar result, which showed that Australian manufacturers have recently experienced an unstable business environment.
Difficulties with lead time	Survey result slightly different to the interview result, with around 65% of the interview participants complaining about lead time uncertainties, while

	only 52.56% of the survey participants mentioned the same difficulties. The slight difference may derive from the different sample size.
Niche market	Similar result; however, the interview results showed a smaller proportion of organisations indicating a niche market as the reason they were able to manufacture within the border.
Apply flexibility and agility in everyday activity	Similar figures; however, the interview results also showed that most manufacturers apply flexibility and agility only to their core company and do not extend it to the whole supply chain.
Moved offshore for cost savings	Similar, with slight variation. The differences may derive from the different sample size. The survey showed more participants who were reluctant to move offshore for cost-reduction purposes.
Manufacturers unaware of unexpected, hidden and invisible costs of offshore operation	Same result, with some Australian manufacturers following the trend to move offshore, but not calculating the unexpected, hidden and invisible costs of offshore operation to the extent possible.
Lack of successful operation and supply chain strategies	Similar result, with several manufacturers applying different operation or supply chain strategies, yet only a small portion of manufacturers having extensive knowledge and applying various supply chain and operation techniques through the whole supply chain.
Manufacturers and the Australian Government are not investing enough in asset and knowledge building	Same result, with both interview and survey results confirming that manufacturers and the Australian Government do not invest enough in the manufacturing sector.
Correlation between product types and geographical distance of production	Same result, with both interview and survey results confirming that it is sometimes beneficial for mass manufacturers to move production to low-cost countries, while innovative products that are more customised and need a quick reaction to changing market demand can be more effectively produced locally.
Extra findings in the survey	<ul style="list-style-type: none"> <li>• The negative effect of a strong economy, high costs and high wages on the manufacturing industry.</li> <li>• Strong Australian unions make costs and prices uncompetitive.</li> <li>• Expensive energy in Australia.</li> </ul>

The above table highlights the similarities and differences of the themes established in the qualitative and quantitative analyses. These findings have implications for future research. An interesting result was that all participants from the interviews and online survey implemented overseas sourcing activity, with all of them sourcing smaller or larger amounts of their materials or parts from overseas. They generally undertook this activity because of the lower price or because the goods did not exist in Australia. Australian manufacturers are aware of the importance of frequent demand information sharing, yet most are not applying this strategy or do not apply it frequently enough, which indicates that most Australian manufacturers need to hold a large inventory because they receive materials or parts from overseas, and most do not apply responsive production because then

they would need their supply to be closer to the site or would need to use a 3PL company to serve a responsive operation. Further, the results also showed that most manufacturers apply agility only to their core company and do not extend it to the whole supply chain. In terms of offshore operation as a cost-saving solution, the survey results indicated more reluctant participants than did the interview results. In terms of the main research question, literature and theoretical framework, the above findings provided the expected result—that agile supply chains can help manufacturers create innovative products closer to the end-user.

## **7.2 Correlation between Research Questions, Theories and Results**

Section 7.1 described the similarities and differences between the qualitative and quantitative findings and highlighted the important and interesting findings, as well as the findings that require further elaboration in future research. This section discusses the correlation between the literature, theoretical framework and findings. Figure 7.1 concludes the results of the data analysis. The three different colours indicate the connection between the data, research question and theory statements.

Figure 7.1 was established to illustrate the correlations between the research question, theory and findings. The figure does not illustrate the correlation with the literature because this would render the figure too complex; however, the connections between the findings, theories, research questions and literature are presented below. In Figure 7.1, the main concepts and themes can be found in the same rectangle, and the sub-nodes are presented attached to the themes in the same rectangle. The concepts and themes in the data correlated to the main question (how can agile supply chains add value to create innovative products closer to the end-user?) also have connections with one of the sub-questions (the effect of a lean, agile and flexible supply chain strategy on operations) and with one of the research theories (DC—establishing an agile, flexible supply chain for long-term competitive advantage). In Figure 7.1, the data analysis connects the questions, theory and findings in the boxes with the green borders.

The main question also has connections with the second sub-question (trends in Australian organisations' local sourcing strategy in the supply chain) and the second theory (TCO). In

Figure 7.1, the data analysis connects these questions, theories and data in the boxes with the red borders. Several established themes are correlated to both sub-questions and both theories. These are represented in the boxes with the blue borders. The figure does not include demographical themes because these patterns had less connection with the research questions and theories. The following concepts, themes and sub-nodes were established through the interview and survey analyses. With the assistance of the concept of hermeneutic cycle, the findings in Figure 7.1 will be examined through the connections between the research questions, literature, theoretical framework and results.

## Correlation between research questions, theories and results

<b>Main question</b> How can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user?		
Effect of lean, agile and flexible supply chain strategy in an operation	<b>Sub-questions</b>	What is the trend in Australian organisations in terms of local sourcing strategy?
<b>Dynamic Capabilities (DC)</b> Regular reconfiguration of internal and external competences if necessary	<b>Theories involved</b>	<b>Total Cost of Ownership (TCO)</b> Hidden, unexpected costs of offshore operation
<b>Applied operation and manufacturing practice</b> <ul style="list-style-type: none"> <li>Some Australian manufacturers apply flexibility, leanness, agility, JIT and forecast sharing, but with limitations</li> </ul>	<b>Manufacturing (geographically)</b> Of 12 participants, three offshore, one global Australia, 1 global US, six onshore, one only customisation	<b>Lack of awareness of hidden and invisible costs</b>
<b>Important factors in supply chain operation</b> <ul style="list-style-type: none"> <li>Quality, affordability, operational excellence</li> <li>Manufacturing close to the market</li> <li>Lack of supply chain network</li> <li>Several large companies with excellent supply chain management able to manufacture in Australia</li> </ul>	<b>Main effect on operation</b> <ul style="list-style-type: none"> <li>Lead time, quality and inventory</li> <li>Demand uncertainty</li> <li>Changing Australian environment</li> <li>Source difficulties in Australia</li> </ul>	<b>Applied management strategy</b> <ul style="list-style-type: none"> <li>Customer service</li> <li>Defined market strategy</li> <li>Operation closer to the market</li> </ul>
<b>Supply chain performance</b> <ul style="list-style-type: none"> <li>Forecast sharing monthly or even less frequently</li> <li>Material supply: all from local and overseas</li> <li>Inventory management: most Australian manufacturers do make-to-stock, huge logistics and warehouse costs</li> </ul>	<b>Which type of manufacturers stay onshore</b> <ul style="list-style-type: none"> <li>Defined market strategy and high technology with high value added</li> <li>Companies with specialised, differentiated products and ability to export</li> <li>Niche market</li> </ul>	<b>Sourcing strategy</b> Low-cost Asian supplier
<b>React to changing business environment</b> <ul style="list-style-type: none"> <li>Move offshore</li> <li>Change business strategy, marketplace or product</li> <li>Apply agility, flexibility</li> </ul>	<b>Lack of investment</b>	<b>Effect of and reason for offshore operation</b> <ul style="list-style-type: none"> <li>Reduced cost</li> <li>Increased value</li> <li>Negative effect on Australian organisations and Australia</li> <li>Problem serving customers on time or huge inventory</li> <li>Companies do not support Australian workforce</li> <li>Massive risk and not every factor can be measured</li> <li>Longer lead time, companies are more open to competitive threat</li> <li>R&amp;D and manufacturing cannot have big distance</li> </ul>
	<b>Lazy in applying changes in operation strategy, prefer to move offshore</b>	

**Figure 0.10: Correlation between Research Questions, Theories and Results**

### **7.2.1 Established Concepts and Themes in Green Boxes**

The concepts and themes below have connections to the main question, the first sub-question and the DC theory, as manufacturers' best practice is to apply agile supply chain management (Agarwal et al. 2007; Malakouti et al. 2017); implement flexibility (Butner 2010; Chan et al. 2009; Fantazy et al. 2012; Singh et al. 2017); regularly reassess the external and internal competencies of the organisation; and, if necessary, change the business strategy (Candace et al. 2011; Chien & Tsai 2012; Jurksiene & Pundziene 2016; Mohamud & Sarpong 2016; Pettus et al. 2009; Vos et al. 2016; Zahra et al. 2006).

#### *7.2.1.1 Theme I: Applied Manufacturing Practice*

(Detailed in Section 5.2.2.4, Theme 3, and Section 6.3, Tables 6.3 and 6.4.)

Both the qualitative and quantitative results showed that the participant organisations acknowledged the importance of agility in operations, yet only a few larger companies applied it to the whole supply chain. The data did not specify why Australian manufacturers do not apply agility through their whole supply chain activity. The findings indicated the same results for leanness, leagility, JIT and flexibility in operations. The literature emphasises agility as the most successful operation strategy in an uncertain business environment (Christopher 2000; Candace et al. 2011); however, leanness, leagility and flexibility are also favourable management strategies (Galankashi & Helmi 2016, Goldsby et al. 2006; Kisperska-Moron & de Haan 2010; Shahin et al. 2016). The finding partially answered the main question, because, although the finding indicated that manufacturers were aware of the benefits of agility, they did not apply it to the extent possible. Australian manufacturers should apply agile supply chain management, including effective flow of 'information' and 'goods' from the supplier's supplier to the retailer (Malakouti et al. 2017; Prater et al. 2001).

### *7.2.1.2 Theme II: Important Factors in Supply Chain Operation*

(Detailed in Section 5.2.2, Theme 7, and Section 6.4, Table 6.9.)

The established themes under this concept are quality, affordability and operational excellence; manufacturing close to the market; lack of supply chain networks in Australia; large companies with excellent supply chain management are able to manufacture in Australia; and some participants are unaware of the term ‘supply chain management’ or believe it indicates the more sophisticated term of ‘logistics’.

Both the interview and survey analyses indicated that manufacturing close to the market was important for 60 to 80% of the participants. The literature also emphasises the positive effect of being geographically close to end-users (Gray et al. 2011; Tunisini et al. 2011; Stanczyk et al. 2017). This finding provided a partial answer to the main research question. Geographical proximity to end-users is important to Australian manufacturers; however, cost savings and the offshoring trend sometimes influence their decisions to implement low-cost-country manufacturing. This result only partially answered the main question because, as the findings propose, agility is the other aspect of successful operation in a high-cost country (Abdoli Bidhandi & Valmohammadi 2017; Eltawy & Galleary 2017; Minter 2009).

However, the result also showed that many manufacturers report a lack of supply chain network in Australia; thus, manufacturers are unable to purchase certain parts or raw materials in Australia because they do not exist. Even more commonly, companies are unable to pay the premium price of Australian materials or parts. The Australian Government and private investors should invest more in the manufacturing sector and pay attention to build up a sufficient and affordable supply network for all sectors. These findings helped answer the main question and the theoretical framework, as well as confirming the literature, as the majority of participants acknowledged that innovative product manufacturers can benefit by producing closer to the market, yet are lacking an affordable and local supply network.

### *7.2.1.3 Theme III: Supply Chain Performance*

(Detailed in Section 5.2.2, Theme 9, and Section 6.4, Tables 6.5 and 6.13.)

The literature indicates that successful companies operate their supply chains with daily or weekly information sharing (Kembro & Selviaridis 2015; Kim & Chai 2017; Prajogo 2012; Song et al. 2016). Both the interview and survey results showed that most of the Australian manufacturers applied monthly or quarterly demand information sharing with suppliers and distributors, which had implications for their production, warehouse and inventory systems, which are normally applied in functional product manufacturing. Seventy to 80% of both the interview and survey participants worked under the category of innovative product manufacturers, which also suggests that they did not apply the correct supply chain strategy, such as a responsive supply chain with daily or weekly information sharing to serve effective production (Choi & Krause 2006; Reichart & Holweg 2007; Singh 2015; Tarafdar 2013). The findings do not support the literature and theoretical framework; thus, Australian manufacturers should seek a solution to enable more effective and responsive operation and supply chain activity.

Moreover, because of the time taken for parts or materials to come from overseas, Australian manufacturers are unable to operate without a huge inventory. Thus, the recreation of an affordable local supply chain would create possibilities for Australian manufacturers to produce more efficiently without a huge inventory (Beer 2004, TAI 2016). This part of the finding has connection to the ‘operational perspective’ and ‘geographical perspective’ of the theoretical framework; thus, innovative product manufacturers need to extend their agile activity and strategic flexibility to the whole supply chain, as well as operating closer to the end-user.

### *7.2.1.4 Theme IV: Reacting to a Changing Business Environment*

(Detailed in Section 5.2.2, Theme 2, and Section 6.4, Table 6.11.)

The data analysis from the qualitative part of the study showed that, although Australian manufacturers invest effort to apply agility in their operations or to change their business strategy, because of different disadvantageous circumstances, they sometimes have no



choice but to move offshore. Further, many Australian manufacturers have changed their marketplace and/or products to survive the recent closing of the automotive sector. In contrast, the results also showed that Australian manufacturers do not extend these strategies to the whole supply chain, which indicates that they do not try hard enough. The theoretical framework suggests that organisations should apply DC in an uncertain business environment, and periodically reassess their capabilities and resources to build long-term competitive advantage (Teece 2010; Defee & Fugate 2010). The theoretical framework and literature were partially supported by this finding because a huge number of manufacturers are still able to produce in Australia, yet many manufacturers choose to move to low-cost countries—mainly mass manufacturers with functional products.

### **7.2.2 Established Concepts and Themes in Blue Boxes**

The following concepts and themes connected to all research question and both theories, as manufacturers' best practice is to apply agile supply chain management (Agarwal et al. 2007; Malakouti et al. 2017) and flexibility (Butner 2010; Chan et al. 2009; Fantazy et al. 2012; Singh et al. 2017). According to the theoretical framework, DC suggests having internal and external competences, with resources and capabilities reassessed periodically (Candace et al. 2011; Chien & Tsai 2012; Jurksiene & Pundziene 2016; Mohamud & Sarpong 2016; Pettus et al. 2009; Vos et al. 2016; Zahra et al. 2006). Further, raw materials and parts should be obtained close to production, while manufacturing should occur close to the market to be efficient and react promptly to changing customer demand and changing business environments (Gray et al. 2011; Platt & Song 2010, Tunisini et al. 2011;). Moreover, manufacturers should calculate the hidden, invisible and unexpected costs wisely before considering going offshore (Hartman et al. 2017; Moser 2011; Saccani et al. 2017; Weber et al. 2010).

#### *7.2.2.1 Theme V: Geographical Perspective*

(Detailed in Section 5.2.2.1, and Section 6.2, Tables 6.1 and 6.2.)

Within the concept of 'manufacturing (geographically)', there were five themes established: Australian global company, not Australian global company, onshore, offshore

and only product customisation in Australia. According to both the interview and survey results, 60 to 70% of the participants—especially innovative product manufacturers—distributed to the Australian market only, which confirmed the theoretical framework, literature and main question. Close production is beneficial for all manufacturers, but especially for innovative manufacturers, who should apply responsive production, which is better when in proximity to the market. However, manufacturing only for a small market can also be a drawback (Hitchcock 2012; Kumar et al. 2006; Murray 2001). Although the main topic of this study was close supply and close manufacturing, the findings also highlighted that supplying only the Australian market, while also entering a different market, would be beneficial in the long term.

#### *7.2.2.2 Theme VI: Main Effect on Operation*

(Detailed in Section 5.2.2, Theme 8, and Section 6.4, Tables 6.6 and 6.7.)

The theme of ‘main effect on operation’ was differentiated into three topics: lead time, quality and inventory; demand uncertainty; and the changing Australian environment and source difficulties in Australia. Based on the outcomes of this research and the established theoretical framework, industrial practitioners—especially the managers of Australian manufacturing companies—can adjust their supply chain arrangements and consider a more focused and in-depth view of agile supply chains with a local sourcing strategy. The findings showed that supply or/and distribution for manufacturers takes too long in Australia because they supply materials or parts from overseas; thus, they need to maintain a large inventory, with high costs involved. The theoretical framework suggests close supply and close distribution to the end-user, which may increase the landed cost of the actual material or part, but would be exchangeable for the inventory and logistical costs. Further, the lead time for supply and distribution would be decreased, and efficient production would be more achievable.

To reflect on these findings, the operational, theoretical and geographical perspectives of the theoretical framework would be the optimal solution for manufacturers. In particular, the geographical perspective (of proximity to the market) is achievable for innovative product manufacturers in Australia. The operational perspective (of agility and

responsiveness) and the theoretical perspective (of DC and TCO) were only partially confirmed by the findings. Companies are aware of the advantages of agility, yet do not apply it to the whole supply chain. Applying agility only to the core company has minor benefits, compared with applying it to the whole supply chain (Agarwal et al. 2007; Defee & Fugate 2010; Faisal et al. 2006; Malakouti et al. 2017; Qrunfleh & Tarafdar 2013). In terms of DC, the findings showed that manufacturers implement several adjustments to remain profitable; however, because of the offshoring trend, some decide to go offshore, rather than trying to change their business strategy, market or product.

According to the theoretical framework, business environment uncertainties can be managed with the implementation of DC through frequently reassessing resources and capabilities, and changing business, market or operational strategies if necessary. Thus, the theoretical framework can help manufacturers resolve situations that affect their operations. Having the theoretical framework built up from the literature, the literature also supports the ideas of ways to react to uncertainties, long lead times and huge inventories (Abdulla 2009; Christopher 2000; Christopher & Holweg 2011; Merschmann & Thonemann 2011; Tunisini et al., 2011).

#### *7.2.2.3 Theme VII: Which Types of Manufacturer Stay Onshore*

(Detailed in Section 5.2.2, Theme 10, and Section 6.4, Table 6.8.)

The concept of ‘which types of manufacturer stay onshore’ included three main themes:

1. innovative product manufacturers, with different sub-nodes: defined market strategies and high technology with high value added, industries where a quick response is important, companies that require flexible supply chains, companies that have uncertainty in demand, and manufacturers of premium-quality products for niche markets and customers who are able to pay premium price
2. companies that are protected by Australian regulation
3. companies that are able to export.

The result of this data analysis indicated several reasons why certain production base activity is viable in Australia. The main theme was innovative product manufacturers,

which confirmed the theoretical framework, research questions and literature (Cagliano et al. 2012; Candace et al. 2011; Fantazy et al. 2009; Kim & Chai 2017) As the findings indicated, more than 70% of the online survey respondents worked for innovative manufacturers that managed production within the border (the online survey result is discussed here because the number of interview participants was less representative within the whole manufacturing sector, compared with the online survey participants). Manufacturers that are protected by regulation and companies that produce for both the local market and for export purposes are also more likely to successfully operate in Australia.

The geographical perspective of the theoretical framework was confirmed by the findings, as innovative manufacturers should produce close to the market to react to the ever-changing customer requirements. The findings indicated that the majority of onshore participants were innovative manufacturers, who stated that proximity to the end-user was an important part of their business strategy. The literature also proposes that responsive and close production is the ideal operation strategy to apply to most innovative product manufacturers. This result also answered the main research question, as proximity to the end-user is beneficial for innovative product manufacturers; however, in the recent volatile business environment, agility is also required to achieve competitive advantage.

#### *7.2.2.4 Theme VIII: Lack of Investment*

(Detailed in Section 5.2.2, Theme 8; and Section 6.4, Tables 6.14 and 6.15.)

Both the interview and survey participants raised the idea that the manufacturing sector in Australia is lacking investment from private investors and the government. This concept has correlation with DC theory, as the need to implement new strategies and new operational techniques coming with the requirement of investment to the business. Considering that DC has a close relationship with supply chain agility and its need to be applied to the business strategy and everyday activities in a volatile business environment, DC theory has correlation with the main research question and the first sub-question (Candace et al. 2011; Hitchcock 2012; Li 2009; Wu et al. 2013).

A specific search for the topic of ‘lack of investment in the Australian manufacturing sector’ in the literature was not accomplished, which reveals an area for future research. The topic about the need for investment in the Australian manufacturing sector does not exist in the academic literature. Interpreting the result and providing an emerging topic to the academic literature, the theoretical framework of this study included the term ‘Lack of investment’ within DC theory, as organisation need to continually reassess and reconfigure the knowledge and the assets, ‘internal and external competences’, of the operation and supply chain (Chien & Tsai 2012; Mohamud & Sarpong 2016).

#### *7.2.2.5 Theme IX: ‘We Were Lazy’*

(Detailed in Section 5.2.2, Theme 8.)

This concept emerged from two interview participants, who explained that they were lazy in implementing different management, production and supply chain strategies, and preferred to move offshore. One stated that this might be a common Australian attitude. As the participant explained, Australia is far from other continents; thus, knowledge and practices sometimes take time to arrive. Moreover, as manufacturers of a wealthy nation, Australians do not think they need to change their best practice. In addition, many managers are unaware of the positive effects of supply chain management on costs and efficiency. This concept is not supported by the literature or theoretical framework, but is important to consider at both the organisational and governmental level; thus, this finding is an additional contribution that requires further research in the future.

#### **7.2.3 Established Concepts and Themes in Red Boxes**

The concepts and themes below have connections to the main question, the first sub-question and the TCO theory, as organisations would benefit from obtaining raw materials and parts closer to production and implementing manufacturing close to the market to be efficient and react promptly to changing customer demand and the changing business environment (Gray et al. 2011; Hannon 2009; Holweg et al. 2011; Tunisini et al. 2011; Platt & Song 2010). Moreover, manufacturers should carefully calculate the hidden,

invisible and unexpected costs before considering going offshore (Hartman et al., 2017, Moser, 2011, Saccani et al., 2017, Weber et al., 2010).

#### *7.2.3.1 Theme X: Lack of Awareness of Hidden and Invisible Costs*

(Detailed in Section 6.4, Table 6.12.)

As the literature highlights, there is a lack of awareness of hidden and invisible costs when organisations consider moving production offshore (Hartman et al., 2017, Moser, 2011, Saccani et al., 2017, Weber et al., 2010). Most companies calculate expenses using the landed cost, which does not incorporate any invisible, indirect or lifecycle costs. The findings of both the interviews and surveys supported this view, with a high proportion of the participants stating that hidden and invisible costs are largely missing from offshore calculations. The literature and theoretical framework also recommend a thorough evaluation that incorporates the available online calculator of TCO. TCO calculation has an indirect relationship with the main research question because, with its assistance, under-evaluated offshore decisions can be prevented. TCO calculation was invented to explore the more than 30 different invisible, unpredictable, indirect and lifecycles costs of onshore operation (Degraeve et al. 2005; Hartman et al. 2017; Moser 2011).

#### *7.2.3.2 Theme XI: Applied Management Strategy*

(Detailed in Section 5.2.2, Theme 3, and Section 6.4, Table 6.16.)

Within this theme, the established subthemes were as follows: customer service, defined market strategy, and operation closer to the market. All three management strategies are important; however, for this study, ‘operation closer to the market’ was the most relevant. The recent literature highlights that increasing numbers of organisations prefer to be close to the market, and those who once chose to implement global supply or offshore production are increasingly deciding on relocation back to the home country (Butner 2010; MH&L 2017; Steinle 2008; Vos et al. 2016). In terms of the theoretical framework, both the interview and survey results showed similar findings about the geographical perspective of production, which demonstrated a high proportion of close production among innovative

product manufacturers in the data, and provided an appropriate answer to the main research question and first sub-question.

#### *7.2.3.3 Theme XII: Sourcing Strategy*

(Detailed in Section 5.2.2, Theme 3, and Section 6.3, Figure 6.1.)

Within this theme, the established subthemes were as follows: low-cost Asian suppliers, affordable Australian suppliers and focusing on quality. As described above, different manufacturers have different priorities for their supply network. Some supply low-cost materials or parts from low-cost countries, others require quality or availability/accessibility, while others have a mixture of suppliers from Australia and overseas. The approach depends on the business strategy and particular market strategy. Thus, supplying activity is not a set solution, yet the optimal strategy is for the supply to be closer to the production to achieve responsiveness and effectiveness throughout the whole supply chain (Liu et al. 2010; Singh 2015; Tarafdar 2013).

The findings answered the research sub-question that examined local sourcing activity. The results showed that all the participants in Australia obtained a smaller or larger portion of their required materials or parts from overseas, which confirmed the other findings that most of the Australian manufacturers worked with a large inventory and large warehouse system, and some applied a 3PL solution. Both systems have higher costs involved than the local sourcing, local manufacturing concept, yet the debate is always whether the low-cost parts and materials sourced from overseas, with their logistical difficulties and larger inventory system, offer a better or worse solution to the higher local costs. The theoretical framework and literature suggest local sourcing activity with responsive and agile production, especially for innovative product manufacturers, which is again difficult to achieve if there are local supply difficulties. Thus, the question emerges: how can premium price be reduced all over the industry and is it worth rebuilding the supply network?

#### *7.2.3.4 Theme XIII: Reasons for and Effects of Offshore Operation*

(Detailed in Section 5.2.2, Theme 1, and Section 6.4, Tables 6.10 and 6.11.)

##### *7.2.3.4.1. Sub-node 1: Reasons to Begin Offshore Operation*

The main theme under this concept is the topic that was mentioned the most—that Australia is a small market and subsequently has raw material supply difficulties (both in terms of affordability and accessibility). Depending on the product type, Australia can be a small market for some mass manufacturers. This finding was confirmed by the literature review (Chaudhry & Hodge 2012; Kuuluvainen 2012; Butner 2010) and partly by the theoretical framework, as the theoretical framework targets innovative product manufacturers, which is the opposite of functional product (mass) manufacturers. As the literature and findings present, in terms of innovative product manufacturers, producing closer to the market is more beneficial than the cost savings obtained by offshore operation.

Mass manufacturers with high density are different. In this case, producing under the concept of economies of scale provides more advantages than proximity to the market (Fantazy et al. 2009; Fisher 1997; Lo & Power 2010; Stevenson & Spring 2009). However, optimally, all types of production base activity should be relatively close to the market to avoid difficulties and extra costs in the supply chain (Holweg et al. 2011; Oshri et al. 2009; Stanczyk et al. 2017; Steinle 2008, Vos et al. 2016). Thus, the theoretical framework was confirmed by the findings and the literature.

As reported by several interview participants, Australia has supply chain network difficulties because raw materials and parts are supplied at premium price or are unavailable in the Australian market. The theoretical framework suggests that innovative product manufacturers should have their supply close to production and should produce close to the market to achieve responsiveness and effectiveness. However, the Australian business environment makes the proposed theoretical framework difficult to accomplish. Further, there are certain supply chain management solutions, such as postponement (both logistics and product) (Boone et al. 2007; Chaudhry & Hodge 2012; Qrunfleh & Tarafdar 2013; Saghir & Barnes, 2016; Yang et al., 2004) and 3PL (Butner 2010; Gao 2013;



Christopher et al. 2011; Christopher et al. 2006; Mangan & Lalwani 2016), which make global sourcing viable, though with less cost and time efficiency (Bhatnagar & Sohal 2005; Christopher et al. 2011; Platt & Song 2010; Steinle 2008; Vos et al. 2016). Summarising the above, in some industries, rebuilding a reliable and affordable supply network in Australia would be complex and difficult, and resolving this difficulty would require assistance from all parties involved, including manufacturers, suppliers and the government.

In terms of reducing cost, it is not always true that mass manufacturers cannot compete in Australia, with the research findings showing that there are still several mass manufacturers in Australia. Some are struggling, while others are not. The findings indicated that manufacturers with advanced operation, production and supply chain activities cope better than do manufacturers without these extra capabilities. These findings appear to confirm the literature and theoretical framework. Although the theoretical framework focuses on innovative product manufacturers, future research should address the viability of mass manufacturing in high-cost environments, considering that increasing amounts of the literature highlight the feasibility of close manufacturing in countries with high labour costs and living standards (TAI 2016).

The theme of ‘difficulty competing with Asian suppliers’ highlights the differences in the prices of products sourced from Australia and Asia. However, while this is true, the economies of scale and the final price of a product are not always the winning feature. Quality and availability sometimes outperform the advantage of low price. This was confirmed by the data results, the literature (Christopher & Holweg 2011; Anonymous 2011; Platt & Song 2010) and the theoretical framework.

#### 7.2.3.4.2. Sub-node 2: Offshoring as a Negative Effect on Australia

Under the theme of ‘negative effect on Australia’, there were several sub-nodes: Australia cannot be a great country without manufacturing, offshore companies do not support the Australian workforce, logistics exercises, problems with serving customers on time, longer lead times, massive risks and inability to measure all factors, companies are more open to

competitive threat, it is not always ideal to produce in Asia, and R&D and manufacturing cannot have large distance.

As reported by the Australian Business Foundation (ABF 2011), manufacturing has an important role in the economy and development of a country. In many cases, the manufacturing sector contributes primarily to the modernisation and expansion of a country. Both the interview and survey results indicated that offshoring, alongside its advantages, has many negative effects on Australia. The literature also confirms this finding, discussing issues such as increased risk, logistical costs and lead time (Abdullah & Verner 2012; Faisal et al. 2006; Gray et al. 2011) and a nation losing its R&D and innovation base (ABF 2011; AFR 2013; DIIS 2017). Further, the theoretical framework was established to highlight these difficulties and provide practical solutions for manufacturers.

### **7.3 Summary**

The discussion in this chapter was based on Table 7.1, Table 7.2 and Figure 7.1. The two tables presented the different and similar themes established under the same topic throughout the qualitative and quantitative analyses, which enabled the researchers to analyse the themes by making connections between them or distinguishing them from each other. Figure 7.1 showed more sophisticated connections, as it explored the correlations between the research questions, theories and findings. Both tables helped explore and interpret the findings at a more advanced level.

After analysing the 12 interviews with NVivo, the findings were still not validated. For confirmation of the qualitative analysis, an online survey was completed during the second study phase. Throughout this chapter, the data were interpreted with the assistance of hermeneutic cycle (Gadamer 1976), which provided the tool to make the analysis rigorous. The findings were connected to the research questions, literature and theoretical framework, which provided feedback to all parts of the study.

The data collection and analysis can be classified as satisfactory because they provided answers to the research questions and raised other emerging questions. The findings

confirmed that agility can add value to producing closer to the market, as the majority of the interview and online survey participants responded positively to this question. However, agility is difficult to achieve in a business environment where manufacturers source a smaller or larger portion of their parts or goods from long distance. In terms of the main research question and first research sub-question regarding trends in local supply and manufacturing, the results highlighted that most local manufacturers supply some of their parts or materials from overseas to save costs or obtain goods that do not exist in Australia. The participants also emphasised the lack of supply network in Australia, which they stated derived from the offshore trend and the fact that several manufacturers have already moved overseas. The question also emerged how premium price can be reduced all over the industry, and whether it is worth rebuilding the supply network in Australia. The findings also indicated that mainly mass manufacturers have moved offshore, while innovative product manufacturers require proximity to the market. The findings in terms of the second research sub-question regarding the effect of lean, agile and flexible supply chain strategies on operations indicated that only big (employee number of 200-999) and large (employee number of 1000 and above) companies successfully applied these management strategies. Chapter 8 provides further responses to the research questions and discussion of the findings.

The majority of Australian manufacturers are unable to operate without a huge inventory, as most import parts or raw materials from overseas. If they do not operate with a large inventory, they involve 3PL companies to handle the inventory. Thus, the recreation of an affordable local supply chain would create possibilities for Australian manufacturers to produce more efficiently without a huge inventory. Further, the literature and theoretical framework suggest that innovative product manufacturers need to extend their agile activity and strategic flexibility to the whole supply chain, as well as operate closer to the end-user. According to the data analysis results and the theoretical framework, close supply and close distribution are the most beneficial for innovative product manufacturers, which may increase the landed costs of the materials or parts, but would be exchangeable with the inventory and logistic costs. Further, the lead time for both supply and distribution can be decreased, and efficient production would be more achievable. Although the main topic of this study was close supply and close manufacturing, the results also indicated that

supplying the Australian market, while entering different foreign markets, would be beneficial in the long term.

Having the theoretical framework built up from the literature, the literature also supports the above ideas of ways to react to uncertainties, long lead times and large inventories. As the theoretical framework suggests, business environment uncertainties can be managed with the implementation of DC, which involves reassessing resources and capabilities frequently, and changing business, market or operational strategies if necessary. Thus, this theoretical framework can be applied to practice to help manufacturers resolve situations that affect their operations. However, both the interview and survey results established the 'lack of investment in Australian manufacturing sector' topic about the need for investments in the Australian manufacturing sector. This topic does not exist in the academic literature, which reveals an area for future research. In addition, many managers are unaware of the positive effects of supply chain management on costs and efficiency. The theoretical framework suggests insightful calculation of TCO; however, the findings indicate that a high proportion of participants stated that hidden and invisible costs are largely missing from offshore calculations. Applying TCO in practice, even using the online TCO calculator, would assist with implementation of this section of the theoretical framework and help enable evaluations of the true cost of offshore operations.

Both the interview and survey results showed similar findings regarding the geographical perspective of production, demonstrating a high proportion of close production among innovative product manufacturers, and providing an appropriate answer to the main research question and first sub-question. In terms of agility, the findings answered the main research question by indicating that agility assists innovative manufacturers to produce closer to the end-user. Chapter 8 highlights the implications drawn from research questions, and the correlation between the literature, theoretical framework and data analysis, and how to implement it in practice.

As the findings showed, the Australian manufacturing sector is experiencing difficulties, with several manufacturers having already moved offshore. Moreover, both mass manufacturers and innovative product manufacturers who operate within the border require the assistance of agility to gain competitive advantage, and need to apply agility not only in

the core company, but throughout the entire supply chain. Australian manufacturers are lacking a local supply network; thus, materials or parts for production are provided at a premium price or do not exist. This business environment means that maintaining efficient production and a responsive supply chain are very challenging tasks. The next chapter discusses the research implications, theory and practice, and limitations, as well as directions for future research and the conclusions drawn from the findings.

## **Chapter 8: Conclusion**

### **8.1 Introduction**

The aim of this study was to examine the viability of onshore manufacturing combined with agile supply chain solutions in the context of Australian manufacturers. Therefore, this study proposed a theoretical framework of why and how to apply agile supply chain management to create innovative products closer to the end-user in the manufacturing industry in Australia. By exploring rich, in-depth qualitative data using the case study approach, this framework was formed by the literature and theories and then enhanced by the data. At the end of the research cycle, the research questions were answered and the findings were interpreted and provided as input for practitioners, researchers and the government, as well as future research.

A search of recent topics in supply chain management identified that Australian manufacturers are going against the American and European reshoring trend. The literature also indicated a strong connection between reshoring decisions and the combination of responsive production and successful supply chain activities. While focusing on the reshoring trend and reviewing academic literature, a question emerged: how can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user?

The method used to answer the research question was a qualitative approach that included an exploratory, interpretive view of supply chain operations, with a case study approach. The research also applied a sequential exploratory strategy, which involved a first phase of qualitative data collection and analysis, followed by a second phase of quantitative data collection and analysis that built on the results of the first qualitative phase. Thus, the main focus was placed on the first phase.

There are several research and academic literature in the specific area of supply chain, operation and manufacturing area and also enough participant in terms of data collection, which provided the background of a rigorous research and allow the study to be a standard

process. Three main concerns were encountered during this process. First, there is a limited amount of research in Australia on this topic; thus, international cases and literature were largely included and referenced. Second, the details of the theoretical framework and methodology section changed several times, as the final outcome of the study influenced both theory and methodology. Third, the number of interviews and online survey participants was slightly less than anticipated. The data collection targeted managers in manufacturing companies, and it was expected to be difficult to contact them and request participation; however, a useful number of participants were approached. There was no presumption about the outcome, as it is well known that Australia is going against the US and European reshoring trend. In terms of agility, it was expected that the study would obtain similar results to the international cases and the literature.

This research is significant because it provides a contrasting view within the onshore–offshore debate on manufacturing, and highlights the importance of supply chain management and agility, which are not always applied to the extent possible. This study went against the current trend in Australia to explore some possibilities that can be applicable and transferable to practice, theory and governmental directions. The findings of this research indicate that agile supply chains have a positive effect on Australian manufacturers, yet most manufacturers do not apply them to the extent that would be possible and beneficial. Accordingly, supply chain management, agile supply chain practice and close production are only moderately supported by Australian manufacturers; however, the findings also indicate that agility helps manufacturers gain competitive advantage. Part of the introduction refers to the consistent themes from Chapters 5, 6, 7.

This chapter includes the following sections. Section 8.2 presents a summary of the literature and theoretical framework. Section 8.3 discusses the correlation between the theoretical framework and data results. Section 8.4 discusses the theoretical framework and theories connected to the study. Section 8.5 answers the research questions. Section 8.6 discusses the research contributions and significance. Section 8.7 discusses the limitations of the research, and finally Section 8.8 presents the conclusion.

## **8.2 Reflections on the Literature and Development of the Theoretical Framework**

This study explored how flexible supply chain activities can add value to onshore manufacturing operations among Australian innovative product manufacturers to potentially gain competitive advantage. During the last five years, with volatility in the business environment increasing significantly (Candace et al. 2011; Christopher et al. 2011), the concepts of local sourcing strategies and onshore manufacturing have been one of the components of flexible supply chains for Australian manufacturers with innovative products (Fantazy et al. 2012; Georgiadis et al. 2011). These concepts provide quick customer response and increase final value by modifying the production process for the purpose of gaining competitive advantage (Abdulla 2009; Butner 2010; Christopher & Holweg 2011; Mentzer 2004). While offshoring is a good strategy for lowering costs and prices for the end customer, there are inefficiencies caused by the shift to local sourcing, such as less flexibility and slower response to changing customer demands. A recent trend in Europe and the US is to remove outsourcing and return to local sourcing (GT 2011; Holweg et al. 2011; The Economist 2012).

Environmental uncertainties, volatile economic situations around the world, a fast-moving business environment and customer demand create the need for quick response to end-users, which requires agile supply chain solutions (Christopher & Holweg 2011). To achieve a competitive priority, manufacturers may need to reconsider their operations, and manufacture or source their products closer to the end-user. There are a growing number of examples (Chaudhry & Hodge 2012, Cooper et al., 1997, Georgiadis et al., 2011; Lau and Lee 2000; Sharma 2010; Stavroulaki & Davis 2010) of individual businesses no longer operating separately, but as a supply chain. For this reason, this study examined this phenomenon as an overall supply chain-related problem, rather than as a single business issue.



### **8.3 Correlation between Theoretical Framework and Analysis**

Figure 7.1 in Chapter 7 illustrated the correlation between the theoretical framework and data collection results. The theoretical framework proposed that innovative product manufacturers in the recent volatile business environment can achieve long-term competitive advantage if they periodically reassess their resources and capabilities to integrate, build and reconfigure internal and external competences; apply strategic flexibility and responsive supply chains; produce closer to the end-user; and examine all the hidden and unexpected costs of offshore operation before considering moving production offshore to low-labour countries.

The results indicated that a few large Australian companies that apply agile supply chain management are able to produce in Australia, as discussed in Chapters 5 and 6. Although these data do not explain the proportion of successful agile supply chains incorporating other strategies and practices, the data do show that implementing an agile supply chain throughout operations can provide a potential long-term competitive advantage for innovative product manufacturers. The results also indicated that, almost exclusively, large companies implement the successful practice of supply chain management, while small or medium-sized manufacturers have only basic knowledge about these activities.

As demonstrated by the results in Chapters 5 and 6, most Australian manufacturers keep large amounts of stock, with its high logistics and warehouse costs, and undertake demand forecast sharing with suppliers and distributors monthly or quarterly. The ability to produce using built-to-order techniques depends on having a stable and reliable supply chain. This raises the question as to why there are still a large number of Australian businesses using the old warehouse stock method of supply. The prevalence of this method of supply chain management indicates that manufacturers are not confident about the supply chain or do not have the financial capacity to invest in experts who could expand the company's possibilities via successful supply chain management activity.

## **8.4 Answering the Research Questions**

As the main objective of a research study to provide answer to the research question/s, the following section is detailing the findings related to the research questions. First, answers to the sub-questions, and finally the main findings for the main research question will be presented.

### **8.4.1 Trends of Australian Manufacturers in Local Sourcing or Onshore Manufacturing**

This section considers the first sub-question: what is the trend among Australian manufacturers regarding local sourcing strategies throughout the supply chain? According to the findings, Australian manufacturers' sourcing strategies vary, with the majority still sourcing materials or parts locally, yet most also sourcing smaller or larger amounts of their materials or parts from overseas. This diverse sourcing activity can be explained by two main effects: (i) the global trend of sourcing from low-labour-cost countries, which has already generated a negative effect, and (ii) the fact that certain raw materials or parts do not exist in Australia anymore.

### **8.4.2 View of Australian Manufacturers on Operating Agile Supply Chains**

Concerning the research sub-question—what is the view of Australian manufacturers in regard to the effect of lean, agile and flexible supply chain strategies on their operations?—the question also asked whether innovative product manufacturers in Australia apply any operational strategies, such as leanness, agility and flexibility, throughout their whole supply chain operation or only in their operations. An agile supply chain enables the flexibility to be responsive to customers' needs and changing demands. An agile supply chain and lean management work together in a synergy that results in a higher level of operation. Agile supply chains allow the company to operate in a dynamic and unpredictable environment.

The findings of this research indicated that the lack of a supply network in Australia is a major issue that prevents Australian manufacturers from sourcing locally, developing agile supply chains and using lean principles. Further, the use of build-to-stock indicates a

problem with agility in the supply chain. An agile, reliable supply chain allows companies to build-to-order. This method carries much less risk in terms of forecasting. Dependence on foreign suppliers is not supportive of built-to-order manufacturing. If the Australian supply chain network could be developed, many companies that are still using build-to-stock methods would switch to the more efficient build-to-order approach. However, further regulations and investments would be required to recreate the foundation of a reliable and affordable supply network in Australia.

#### **8.4.3 Answer to the Main Research Question**

The main question—how can agile supply chain management add value for Australian manufacturers to create innovative products closer to the end-user?—also explored whether those activities are sufficient for innovative product manufacturers to stay in the country. The results of this study indicated that Australian manufacturers are not using agile supply chains and lean manufacturing processes to the extent possible. The number of cases using outdated supply chain methods outweighed the number of companies using more efficient agile supply chains and lean management techniques. This can be a future research consideration in the Australian manufacturing sector. In contrast, several large companies claimed that their profitability and success derived from agile supply chain practice that they applied through the whole supply chain (from the supplier's supplier to the end-user).

In terms of product type—innovative product manufacturers or functional product manufacturers (mass manufacturers)—according to the research results, it is beneficial for mass manufacturers to move production to low-cost countries; however, innovative products that are more customised and require quick reactions to changing market demand can be more effectively produced locally. The results highlighted that, in most cases, innovative product manufacturers have the benefit of manufacturing closer to the market because the many variations and short lifecycle of the product mean that the supply, production and distribution are more efficient when closer to the market.

There are several reasons that Australian manufacturers go offshore, yet many different reasons that some can stay. Some of the study participants stated that companies can effectively operate in Australia if they have high technology and can high value add, even

when the high labour costs work against them. Others highlighted that manufacturers with a defined market strategy and high technology are also able to produce within the border; however, the best combination is to produce for both the Australian market and for exports. Manufacturers with special and differentiated products should become global companies, and at least introduce and sell their products through global distributors. In an industry where quick response is important, manufacturers should remain close to the market, apply agile supply chain management and produce cost-effectively in Australia. The results of this study indicate that the Australian manufacturing sector has several underlying problems that could pose a threat in the future, yet also indicate that an agile supply chain as a practice has potential benefits for manufacturers to gain competitive advantage.

## **8.5 Research Contributions and Significance**

This study addresses an important research gap in relation to Australian supply chain and operation studies by identifying and joining two theoretical frameworks. To date, supply chain agility in offshore and onshore manufacturing research has lacked a strong experimental background, which may hinder a complete understanding of this complex phenomenon. By combining the two theories, this research presents a fresh view to study onshore manufacturing with an agile supply chain. A single theory may have limited explanatory power; thus, combining these theories can lead to developing a more complete understanding of the situation.

Firms' application of strategic agility into their process to adapt to increased environmental turbulence can be achieved most ideally in the same business environment where the demand occurs. By building strategic agility through the entire supply chain, which is ideally within the Australia border, efficient and responsive production can be achieved, which helps firms react promptly and successfully to the market demand, as well as outline fluctuation and uncertainty in customer demand. The structure of this case study research accommodated the emerging question of the onshore–offshore debate in a changing business environment.

From an academic standpoint, this research represents one of the initial empirical studies to focus on agile supply chain management along with onshore manufacturing. Specifically, this research:

- developed and empirically tested a theoretical framework that investigated how companies can manipulate their sources and capabilities in a rapidly changing environment, the relevant antecedents and outcomes, and how to apply TCO calculation (including hidden, invisible and lifecycle costs) before proposing to move offshore
- provided a valid and reliable understanding of the advantages of onshore manufacturing, and business contextual dynamism for consumer requirements
- contributes to the literature by applying this conceptual model to the Australian manufacturing industry.

In short, the outcomes of this research not only provide an exploratory foundation for future research on the subject of agile supply chains, but also reveal the procedure of generalising a conceptual model in a particular situation context.

Three primary contributions emerged from this study. First, this paper addressed the issue of the possible limits of the offshore environment to operating efficiently and meeting customer demand without constraints. The literature indicates that firms seeking to optimise their opportunities through global sourcing may not always be viable (Moser & Lang 2011). Local sourcing and onshore manufacturing are essential when a supply chain strategy focuses on core competencies and on achieving improvements in profitability, efficiency and flexibility (Picker 2016). Further, manufacturers should increase their ‘local for local’ strategy, considering that numerous global sourcing ventures among frequent innovators are not economically viable because of unexpected, hidden and dynamic costs. Global sourcing is inflexible because of its complexity; thus, firms cannot react rapidly to consumer trends for both products and geographic areas (Christopher et al. 2011; Hannon 2009; Holweg et al. 2011). After a detailed review and analysis of the literature, the study’s theoretical framework was proposed.

Furthermore, the findings of this study indicate the possible limitations to offshore operations and/or global sourcing among frequent inventor manufacturers. Innovative product manufacturers are always struggling with time. Thus, the assumption that offshore manufacturing necessarily optimises opportunities in the supply market may not hold for innovative product manufacturers. Manufacturers with high technology who can high value add, companies that apply a defined market strategy, and manufacturers with special and differentiated products with a large variety in the finished product are able to manufacture in Australia. These features are the main characteristic of innovative products. Most Australian manufacturers with innovative products are able to produce in Australia, and most are not seeking to move to low-labour-cost countries. Further, the results also indicated that Australian manufacturers are less vulnerable if they produce for the local market, while also seeking to export; apply responsive production and agility throughout the whole supply chain; from the suppliers' supplier to the end-user.

Second, the theoretical contribution of this paper is the integration of DC and TCO analysis into the management and supply chain domain in general, and into the onshore–offshore operation debate in particular. This research is significant because it contributes to academia, practitioner communities and the government, as the outcomes of this research not only provide an exploratory foundation for future research on the subject of agile supply chains, but also reveals the procedure of generalising a conceptual model in a particular context. Further, the findings of the literature review and theoretical framework enrich the discourse of strategic flexible management by supporting the view that DC and resources enable firms to achieve sustainable competitive advantage, which can be located beyond the boundaries of Australia.

Finally, the managerial contribution is that, for mass manufacturers, sourcing or operations in low-labour-cost countries may be a viable way to reduce costs. However, global sourcing can damage the operations of frequent inventors who produce innovative products because of the inhibiting factors to responding quickly to end-users. Considering that global sourcing may cause negative effects on lead time, inventory levels, time to market, quality, customer service and flexibility—not to mention other hidden and unpredictable costs—

offshore manufacturing and global sourcing may not be the preferable operational strategy, especially for manufacturers with innovative products.

### **8.5.1 Contributions to Academia**

For the first time, the combination of DC and TCO theories has been used as a lens to examine the onshore–offshore debate, as a search of the academic literature discussing the combination of two theories this context has not been examined and so these two theories may not have been considered to be used together. Perhaps the single theories have been adequate thus far in previous research in this area. The theoretical framework also showed that the specific choices of combined theories can help organisations maximise the desirable characteristics of their operational outcome. In this study, the theoretical framework applied two theories that supplemented each other: DC and TCO. To investigate the viability of the competitive advantage of a company in a rapidly changing business environment or when a manufacturer is struggling with uncertainty in customer demand and considering moving production offshore to save costs, this study suggested incorporating two investigations with the two proposed theories of DC and TCO.

First, manufacturers should examine their main operation and management strategy and their resources and capabilities, and make prompt changes to meet customer and stakeholder requirements. If necessary, manufacturers should change production strategy, such as implementing well-known successful operation or production activities—not only through the core company, but also throughout the whole supply chain. Alternatively, the manufacturer could implement different changes, such as changing marketplace or product type. Second, companies should consider all the invisible and hidden costs of offshore operation by considering all elements of the online TCO calculator (Table 3.2) to be able to investigate all the unexpected future costs and undesirable events associated with overseas production.

This study provides a theoretical contribution for practitioners because it proposes both a conceptual model and a complete practical solution for manufacturers to evaluate the viability of their operation within the local business environment. This study combined two theoretical perspectives, and neither DC nor TCO can be disregarded in a thorough

evaluation of the viability of local manufacturing. If a manufacturing company is struggling in the local marketplace and considering moving offshore, it should apply DC when implementing organisational flexibility and modifying strategy, and calculate the hidden and unpredictable costs with TCO before deciding to move production overseas. Manufacturers with innovative products operate more efficiently closer to the market because an effective and responsive operation is only viable at a close distance. Hence, the proposed theoretical framework is essential for manufacturers with innovative products, yet can be applicable to any production involved company.

The theoretical contribution of combining these two theories is that companies should not only assess visible costs, but also implement strategic changes and consider invisible and hidden costs when examining the viability of local production. Removing one theory from the theoretical framework would reduce the strength of the true evaluation. For instance, a manufacturer may have already examined and implemented different operation, production and supply chain activities, yet those strategic movements have not truly assisted the company to gain competitive advantage. This company is considering moving offshore and calculated only the visible cost of the overseas operation. Without a comprehensive TCO calculation, this company would decide to move overseas and may regret this decision later. Further, if a manufacturer investigates all the accurate future costs of an onshore operation, yet did not implement any strategic changes, they may think that overseas production would be beneficial. Thus, both strategic actions of DC and TCO calculation should be considered when manufacturing enterprises encounter difficulties. For the first time, this research has combined these theories in a theoretical framework and suggested applications for practitioners.

### **8.5.2 Contributions to Australian Government**

Within Australia, the government established a taskforce (DIISRTE, 2012) to explore Australian manufacturing (issued in July 2012). The taskforce's report stressed the importance of keeping Australian manufacturers within the country, and proposed several suggestions to achieve this, yet few of these suggestions seem to be realised. Similarly, the outcomes of the taskforce focused largely on government support and intervention, but did not propose a business strategy as a 'self-sufficient organisational fulfilment'. Therefore,



this research provides more insight into the areas that the government highlighted as part of this taskforce in identifying the advantages of onshore manufacturing.

This study indicates the difficulties encountered in the manufacturing sector by highlighting the specific areas where governmental assistance and influence is required. The Australian manufacturing sector is experiencing a ‘vicious circle’, in which companies are unable to apply efficient production and responsive supply chains because of the lack of local supply networks, which then delays the efficient flow of material and goods from the supplier to the end-user. Without governmental regulation and assistance, a healthy supply chain system is unable to rebuild itself. Materials, parts and finished products from low-cost countries are maintaining healthy competition and optimising the price in the market, but enable Australian manufacturers and suppliers to be in a better position. Australian suppliers have recently been placed in a disadvantageous situation because Australia’s high operational costs and other factors force them to keep prices high, which places foreign competitors in a better position. Governmental action is required to build competition that is beneficial for all parties.

This research also provides insightful knowledge to the government regarding the areas where further education is required in the industry. With specific advanced knowledge obtained from successful case studies in relation to management and operation strategies—such as dynamic operation, efficient production and responsive supply chains—the education sector should broaden the knowledge base of managers in the manufacturing sector.

### **8.5.3 Contributions to Practitioners**

For practitioners, this research provides insight into how companies can gain competitive advantage in a volatile business environment. This research investigated the debate of local sourcing versus low-cost-country sourcing, focusing on Australia. Organisations need to select business models that place them in a position where they are not negatively affected by competitive forces or industrial characteristics, as well as considering agility in business models so they are able to deal with dynamic changes in the industry structure as they occur.

The framework developed as part of this study allows organisations to deconstruct their business models to a level that can be used as a guide to show how the organisation can construct alternative business models, and how specific business model components—such as responsive supply chains and efficient production—may be redesigned to better exploit the positive characteristics of the operation (see examples in Chapter 5). Further, combining the two theories enables manufacturers to evaluate their offshore need.

The findings particularly indicate that Australian supply networks lack suppliers and healthy competition, which implies that Australia needs private investors and governmental assistance to rebuild its supply network. Therefore, business models—such as local supply and local production with responsive supply chains—would assist Australian manufacturers to perform effectively. Companies would have a good opportunity to enter the manufacturing industry as a supplier if the government helped them with foreign trade regulations.

#### **8.5.4 Future Studies**

For future directions, this study suggests the following:

- Small and medium-sized manufacturers should consider applying responsive supply chain principles and efficient production.
- Australian manufacturers should not only produce for Australian markets, but also enter international markets (even to find foreign distributors).
- In reference to the rapidly changing business environment during the last decade, Australian manufacturers should reassess their strategies regularly, and, if necessary, change their products, marketplace or whole company strategy, involving DC and agile supply chain management.
- Before making the decision to move production offshore, manufacturers should wisely calculate and consider all the hidden, unexpected and invisible costs of offshore production.
- Australian manufacturers require more investment from the government in terms of assets and knowledge base.
- The Australian Government needs assistance to create a free market in Australia.

- Further research on viable close production, successful supply chain implementation and agile practice will add greater insight to future studies in the manufacturing sector and supply chain management areas.

The above implications do not provide complete solutions, yet are indications for further studies.

## **8.6 Limitations of the Research**

The present analysis has certain limitations, with further review recommended to determine the viability of this theoretical framework for different cultural and geographical distances. This research mainly addressed the issue of avoiding offshore manufacturing between continents, whereas sourcing within the same continent could be feasible. Hence, further research could consider the link between cultural and geographical distance regarding operational and managerial strategies. Other criteria may need to be applied to firms that mostly source simple semi-finished or finished commodities from overseas, or mass manufacturers that decide to implement offshore operation. Overall, by measuring the advantages and disadvantages associated with geographical and cultural distances, decisions cannot yet be investigated satisfactorily, and require further attention.

Further limitations derive from the research design being focused on one industry. A possible solution is to extend the scope of the research, with more in-depth analysis involving more participants from different manufacturing sectors. Further, clear direction from the government may be required in terms of the advantages and disadvantages of offshore manufacturing activity, targeting the interests of the whole Australian society as a long-term consideration. A further limitation is that the online response rate was not high enough; however, considering that the online survey was conducted to validate the qualitative data, this response rate was sufficient. However, future research should target higher response rates to validate the preliminary data.

A possible limitation to the theoretical framework derived from narrowing the manufacturing industry to innovative product manufacturers; however, the proposed theoretical framework may fit any manufacturing enterprise, as the recent manufacturing

trend and rapidly changing business environment require responsive production, whether it is functional or innovative product manufacturing. Moreover, the theoretical framework may not be applicable to any business environment, especially where circumstances are only comply with global supply chain solutions.

Overall, applying an agile supply chain strategy to manufacturing operations is not a well-known practice among Australian manufacturers; thus, the characteristics of the strategy's business operations can be extended widely. The application of responsive production mainly exists among large manufacturers; therefore, for this project, transferability is expected to be at a medium level. A high transferability level of the theoretical framework can only occur when the Australian supply network has significantly improved.

In addition, the use of a case study approach, the detailed documentation of the whole research process, the in-depth study of agile supply chain strategy in the manufacturing sector using qualitative analysis with a sequential exploratory strategy, and the theoretical framework with different business perspectives contribute to the transferability, reliability and recoverability of the findings. This was also made possible by being able to access information at a deep level, and by understanding this information at a causal level through close collaboration with the industry participants.

The findings of this study are reliable because this research is considered a valid measure of the intended parameters, and the coding method is considered an accepted standard method for this particular type of project. In terms of transferability, the research questions were developed from the purpose of the research and from the literature review. The interview process involved a semi-structured approach, with interview questions developed to answer the research questions. The online survey validated the findings. This chosen research method was believed to be a reliable way to address the research variables. The findings of this study are transferable and recoverable because this research study used analytical generalisation; thus, the findings can be applied to other settings and organisations.

## 8.7 Conclusion

This research was classified as an exploratory case study that was conducted via a qualitative method with interviews, with the interview results validated by online survey. This research has highlighted the issue of the possible limitations to offshore operations and/or global sourcing among frequent inventor manufacturers. Innovative product manufacturers are always struggling with time. Thus, the assumption that offshore manufacturing necessarily optimises opportunities in the supply market may not hold for innovative product manufacturers.

The findings indicate that manufacturers with high technology who can high value add, companies that apply a defined market strategy, and manufacturers with special and differentiated products with a large variety in the finished product are able to manufacture in Australia. These features are the main characteristic of innovative products. Most Australian manufacturers with innovative products are able to produce in Australia, and most are not seeking to move to low-labour-cost countries. Further, the results also indicated that Australian manufacturers are less vulnerable if they produce for the local market, while also seeking to export; apply responsive production and agility throughout the whole supply chain; from the suppliers' supplier to the end-user.

In conclusion, the Australian manufacturing sector needs government action and private investors to invest and support education and training about how to apply suitable supply chain principles with efficient production, how to enter different markets, how to react promptly to business environmental changes, and how to calculate the invisible costs of offshore operation. These practices could prevent manufacturers going offshore—including both innovative product manufacturers and mass manufacturers. Australia is a rich and great country that should not give up on its manufacturing sector because it will lose more of its innovation and engineering industries, as well as workforce and know-how.

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## Appendices

### Appendix I: List of Publications about Local Manufacturing, Onshoring, Reshoring and Related Studies

Author	Title	Journal and related industry reports
Abdullah and Verner (2012)	‘Analysis and Application of an Outsourcing Risk Framework’	<i>Journal of Systems and Software</i> , vol. 8, no. 8, pp. 1930-1952
Anonymous (2005)	‘Distorted Outsourcing Decisions: Product Redesign, Not Manufacturing Outsourcing’	<i>Strategic Direction</i> , vol. 21, no. 3, pp. 35-37
Anonymous (2013)	‘Reshoring Manufacturing: Coming Home. A Growing Number of American Companies are Moving Their Manufacturing back to the United States’	<i>The Economist Magazine</i> , 19 January, vol. 406, no. 8819, p. 8
Arika (2013)	‘Framing the Offshoring and Re-shoring Debate: A Conceptual Framework’	<i>The Journal of Global Business Management</i> , vol. 9, no. 3, pp. 73-83
Arlbjorn and Mikkelsen (2014)	‘Backshoring Manufacturing: Notes on an Important but Under-researched Theme’	<i>Journal of Purchasing &amp; Supply Management</i> , vol. 20, no. 1, pp. 60-62
Bailey and De Propris (2014)	‘Manufacturing Reshoring and its Limits: The UK Automotive Case’	<i>Cambridge Journal of Regions, Economy and Society</i> , vol.7, 379–395
Borkes (2013)	‘A New Manufacturing Model for Successfully Competing in High Labor Rate Markets how to Minimize Labor and Material, the Controllable Contributions to a High-tech Electronic Product’s Cost, and Assess a Manufacturing Region’s Business Climate’	First Presented at the Pan Pacific Microelectronics Symposium, Maui, Hawaii, 22 January
Christopher et al. (2011)	‘Approaches to Managing Global Sourcing Risk’	<i>Supply Chain Management: An International Journal</i> , vol.16, no. 2, pp. 67-81
Ellram et al. (2013)	‘Offshoring and Reshoring: An Update on the Manufacturing Location Decision’	<i>Journal of Supply Chain Management</i> , vol. 49, pp. 14-22
Fine (2013)	‘Intelli-Sourcing to Replace Offshoring as Supply Chain Transparency Increases’	<i>Journal of Supply Chain Management</i> , vol. 49, pp. 6-7
Fratocchi et al. (2014)	‘When Manufacturing Moves Back: Concepts and Questions’	<i>Journal of Purchasing and Supply Management</i> , vol. 20, no. 1, pp. 54-59
Gao (2013)	‘Collaborative Forecasting, Inventory Hedging and Contract Coordination in Dynamic Supply Risk Management’	Working paper, University of California, Riverside
Garza (2013)	The Case for Re-shoring Manufacturing	<i>Journal of Purchasing and Supply</i>

	Jobs'	Management, vol. 20, n. 1, pp. 54-59
Gray et al. (2011)	'Quality Risk in Offshore Manufacturing: Evidence from the Pharmaceutical Industry'	<i>Journal of Operations Management</i> , vol. 29, no. 7-8, pp. 737-752
Gray et al. (2013)	'The Reshoring Phenomenon: What Supply Chain Academics Ought to Know and Should Do'	<i>Journal of Supply Chain Management</i> , vol. 49, pp. 27-33
Gruenes et al. (2011)	'International Sourcing: Offshore or Near Shore?'	Grand Thornton Research, Institute of Supply Management and <i>World Trade Magazine</i>
Holden (2012)	'US Manufacturers Coming Home?'	<i>Research-Technology Management</i> , vol. 55, no. 5
Holstein (2010)	'The Case for Backshoring'	<i>Strategy + Business, Operations &amp; Manufacturing</i>
Holweg et al. (2011)	'On Risk and Cost in Global Sourcing'	<i>International Journal of Production Economics</i> , vol. 131, no. 1, pp. 333-341
Kazmer (2014)	'Manufacturing Outsourcing, Onshoring, and Global Equilibrium'	<i>Business Horizons</i> , vol. 57, no. 4, pp. 463-472
Kinkel (2011)	'Trend in Production and Backshoring Activities: Changing Patterns in the Course of the Global Economic Crisis'	<i>International Journal of Operation &amp; Production Management</i> , vol. 32, no. 6, pp. 696-720
Lee (2014)	'Making Better Offshoring and Onshoring Decisions'	<i>Journal of Corporate Accounting and Finance</i> , vol. 25, pp. 35-38
Manyika et al. (2012)	'Manufacturing the Future, the Next Era of Global Growth and Innovation'	McKinsey & Company Global Institute, New York
McMeekin and McMackin (2012)	'Reshoring US Manufacturing: A Wave of the Present'	<a href="http://businessclimate.com/blog/2012/09/reshoring-u-s-manufacturing-a-wave-of-the-present">http://businessclimate.com/blog/2012/09/reshoring-u-s-manufacturing-a-wave-of-the-present</a>
Minter (2009)	'Moving Sourcing Closer to Home'	Industry Week
Moser and Lang (2011)	'Reshoring Manufacturing Can Increase Your Competitiveness'	<i>Fastener Technology International</i> , vol. 34, no. 5, pp. 26-35
Moutray and Swift (2013)	'Looking Ahead: Opportunities and Challenges for US Manufacturers'	<i>Business Economics</i> , vol. 48, no. 2, pp. 121-133.
Oshri et al. (2009)	'Global Sourcing: Recent Trends and Issues'	<i>Information Technology &amp; People</i> , vol. 22, no. 3, pp. 192-200
Pagani (2004a)	'Manufacturing Execs Should Focus on Becoming Lean Before Going Offshore'	<i>Financial Times</i>
Platt and Song (2010)	'Overseas Sourcing Decision—The Total Cost of Sourcing from China'	<i>Supply Chain Management: An International Journal</i> , vol. 15, no. 4, pp. 320-331
Reichart and Holweg (2007)	'Creating the Customer-responsive Supply Chain: Reconciliation of Concepts'	<i>International Journal of Operation &amp; Production Management</i> , vol.27, no. 11, pp. 1144-1172
Ritter and Sternfels (2004)	'When Offshore Manufacturing Doesn't Make Sense'	<i>McKinsey Quarterly, Wall Street Journal</i>

Salazar and Lunsford (2014)	‘Onshoring: An i-Opener for Apple, Inc.’	<i>International Journal of Trends in Economics, Management and Technology</i> Vol. 3.2014, 2, p. 8-12
Sarder et al. (2014)	‘Understanding the Reshoring Decision-making Process Using AHP Approach’	<i>Proceedings of the 2014 Industrial and Systems Engineering Research Conference</i> , viewed XCDsystem.com, 12 August
Steinle (2008)	‘Limits to Global Sourcing? Strategic Consequences of Dependency on International Suppliers: Cluster Theory, Resource-based View and Case Studies’	<i>Journal of Purchasing &amp; Supply Management</i> , vol. 14, pp. 3-14
Tate (2014)	‘Offshoring and Reshoring: US Insights and Research Challenges’	<i>Journal of Purchasing and Supply Management</i> , vol. 20, pp. 66-68
Tunisini et al. (2011)	‘Is Local Sourcing out of Fashion in the Globalization Era? Evidence from Italian Mechanical Industry’	<i>Industrial Marketing Management</i> , vol. 40, no. 6, pp. 1012-1023
Weber et al. (2010)	‘Low Cost Country Sourcing and its Effects on the Total Cost of Ownership Structure from Medical Devices Manufacturer’	<i>Journal of Purchasing and Supply Management</i> , vol. 16, no. 1, pp. 4-16
Williams (2009)	‘International Sourcing: Offshore or Near-shore?’	<i>Trade Publication, World Trade</i> , vol. 22, no. 5, p. 46
Worley (2012)	‘Outsourcing, Offshoring, Nearshoring, Onshoring—What’s Going On?’	<i>Legal Information Management</i> , vol. 12, pp. 9-11



## Appendix II: Previous Studies Highlighting the Importance of Agility

Area of study	Authors	Year published
Integrated product and manufacturing design	Kusiak and He	1997
	Wang et al.	2002
	Zhang et al.	2007
Dynamic process planning	Feng and Zhang	1998
	Lim and Zhang	2003
Responsive production scheduling	Majone and Naso	2003
	Lim and Zhang	2004
	Lim et al.	2009
Flexible facility layout	Montreuil et al.	1999
	Goh and	2003
	Anosike and Zhang	2009
Virtual enterprises	Cao and Dowlatshahi	2005
	Khalil and Wang	2002
The optimisation of supply chains	Mason-Jones and Towill	1999
	Zhang et al.	2003
	Akanle and Zhang	2008
The understanding of consumer dynamics	Zhang and Zhang	2008
The creation of flexible workforces and organisational structures	Crocitto and Youssef	2003
What characterises an agile enterprise; agility as a term	Iacocca Institute	1991
	Goldman et al.	1995
	Kidd	1995
Different methodology supporting agile implementation	Dove	1996
	Booth	1996
	Gehani	1995
	Gunasekaran	1999
The identification of agility drivers	Sharifi and Zhang	2001
Different agility drivers and capabilities	Yusuf and Adeleye	2002
The effect of information technology and virtual organisation on the performance of agile manufacturers	Cao and Dowlatshahi	2005
Different agility strategies	Zhang and Sharifi	2007

### Appendix III: Interview Participants' Demographic Data

	Com	Company profile	Manager position	Location	Manufacturing site	Product type	Employee number	Raw material or finished product location
1	A	Automotive	Supply Chain Manager	Adelaide	Thailand	Mass manufacturer	11,000 all over the world	Global sourcing
2	B	Automotive component and container manufacturer	General Manager	Adelaide	Adelaide, China and Malaysia	Mass manufacturer	95	40% Australia, 60% overseas
3	C	Steam boiler manufacturer	Owner/General Manager	Sydney	Sydney	Mass manufacturer/innovative product	30	Australia and overseas
4	DB	Commercial storage system manufacturer	Executive General Manager	Melbourne	China, America and Vietnam	Mass manufacturer	120 outsourced	Overseas
5	DS	Commercial storage system manufacturer	General Manager	Sydney	China and Southeast Asia	Mass manufacturer	120 outsourced	Overseas
6	E	Industrial fastener manufacturer	General Manager	Melbourne	Melbourne	Mass manufacturer	36	Australia and China
7	F	Security device manufacturer	General Manager	Melbourne	Melbourne	Mass manufacturer	65	Australia, Germany, Japan and China
8	G	Valve and control system manufacturer	General Manager	Sydney	Houston, China and India	Innovative product		Houston, India and China
9	H	Automotive and industry batteries manufacturer	Supply Chain Manager	Brisbane	Brisbane	Mass manufacturer/innovative product	600	Australia and overseas

10	I	Biotechnology	General Manager	Melbourne	Melbourne	Mass manufacturer/ innovative product	12,000 all over the world	Close to each facility around the world
11	J	Transformer manufacturer	Owner/General Manager	Melbourne	Melbourne	Mass manufacturer/ innovative product	120	Mostly from overseas
12	K	Small domestic appliances manufacturer	Business Manager	Sydney	China	Mass manufacturer	200 outsourced	China

## Appendix IV: Ethics Approval Number 1



Business College Human  
Ethics Advisory Network  
(BCHEAN)

Building 108, Level 11  
239 Bourke Street  
Melbourne VIC 3000

GPO Box 2476V  
Melbourne VIC 3001  
Australia

Tel. +61 3 9925 5555  
Fax +61 3 9925 5624

### Notice of Approval

Date: 19 November 2013

Project number: 15775

Project title: *Adding Value to Onshore Manufacturing in Australia: an Exploration of Flexible Supply Chain*

Risk classification: Low Risk

Principal Investigator: Dr Konrad Peszynski  
Student Investigator: Ms Andrea Gyarmathy  
Other Investigators: Dr Leslie Young

**Project Approved: From: 14 November 2013 To: 16 July 2016**

### Terms of approval:

- Responsibilities of the principal investigator**  
It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.
- Amendments**  
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
- Adverse events**  
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
- Participant Information and Consent Form (PICF)**  
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
- Annual reports**  
Continued approval of this project is dependent on the submission of an annual report.
- Final report**  
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
- Monitoring**  
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
- Retention and storage of data**  
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,

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Professor Roslyn Russell  
Chairperson  
RMIT BCHEAN

## Appendix V: Ethics Approval Number 2



Deputy Pro Vice-Chancellor  
(Research & Innovation)  
College of Business

GPO Box 2476  
Melbourne VIC 3001  
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### Notice of Approval

Tel: +61 3 9925 5432  
Fax: +61 3 9925 5624

Date: 15 November 2016

Project number: 20437

Project title: *Exploring agile supply chains for creating innovative products closer to the end-user*

Risk classification: Low Risk

Chief Investigator: Dr Konrad Peszynski  
Other Investigator: Dr Leslie Young  
Student Investigator: Ms Andrea Gyarmathy

**Project Approved:**                      **From: 15 November 2016**                      **To: 4 September 2017**

### Terms of approval:

#### *Responsibilities of the principal investigator*

It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. *Amendments*  
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
2. *Adverse events*  
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
3. *Participant Information and Consent Form (PICF)*  
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
4. *Annual reports*  
Continued approval of this project is dependent on the submission of an annual report.
5. *Final report*  
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
6. *Monitoring*  
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
7. *Retention and storage of data*  
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,

Associate Professor Penny Weller  
Chairperson  
RMIT BCHEAN

## Appendix VI: Interview Questions

Demographic questions	<ul style="list-style-type: none"> <li>• Industry</li> <li>• Your position</li> <li>• Number of employees</li> <li>• Region of operation</li> <li>• Does your organisation supply raw or semi-finished material from overseas? Do you have plant/s in Asia?</li> </ul>
Supply chain performance	<ul style="list-style-type: none"> <li>• Is your company's operation is extended through your partners' operation? Does your company apply any kind of supply chain strategy (strategic partnership; collaborative planning, forecast and replenishment; or information technology solutions throughout the supply chain)?</li> <li>• Does your company measure the company and entire supply chain performance?</li> <li>• Does your company apply any management strategy to gain competitive advantage? Please determine it.</li> <li>• Regarding supply chain competitiveness, which kind of operational constructs do you think affect the company/supply chain's performance most (e.g., lead time performance, inventory, customer service, flexibility, time to market, quality)?</li> <li>• Is the average variability in delivery to the end-user high in your organisation?</li> </ul>
Uncertainty in market environment	<ul style="list-style-type: none"> <li>• Is your company/supply chain affected by the high density of uncertainty in its market environment?</li> <li>• What kind of uncertainty does your company/supply chain experience (e.g., supplier, process, demand uncertainty)?</li> </ul>
Offshore outsourcing trend in Australia	<ul style="list-style-type: none"> <li>• What do you think about the offshore outsourcing trend in Australia?</li> <li>• Why do you think other Australian organisations choose onshore manufacturing, despite the high labour cost?</li> <li>• What kind of organisations do you think choose onshore operation and local sourcing? Why?</li> <li>• What are the important factors when determining plant location (e.g., proximity to customers or supplier, business climate, legislation, tax incentives, low labour rate)?</li> <li>• If you are operating offshore, are you satisfied with your company's demand fulfilments, order completeness, delivery performance and lead time?</li> <li>• Do you think that only mass manufacturers decide to go offshore, or do frequent product innovators move offshore as well?</li> </ul>
Different operational strategies applied in your company	<ul style="list-style-type: none"> <li>• What kind of manufacturing practice have you applied to your company or supply chain (e.g., just-in-time, manufacturing cells, ISO 9000, predictive maintenance, preventive maintenance, quick changeover, statistical process control, supplier and customer focus, total quality management, value engineering, vendor certifications)?</li> <li>• Have you heard about flexible supply chain management?</li> <li>• What is your view of the effect of agile and flexible supply chain strategies on manufacturing operations?</li> <li>• Have you applied a flexible manufacturing system to your organisation or supply chain?</li> </ul>

	<ul style="list-style-type: none"> <li>• What kind of supply chain strategy have you applied to your company or supply chain (e.g., lean, agile, flexible)?</li> <li>• Do you think that flexible supply chain management can add value to onshore manufacturing among Australian manufacturers?</li> </ul>
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## Appendix VII: Word Cloud

Using a simple tool in NVivo, the main topic could be confirmed by generating a ‘word cloud’. This map was created by displaying the 100 most frequently used words in the data, including words with four or more characters.



**Figure A.1: Word Cloud of the 100 Most Frequently Used Words in the Data**

As can be seen in the word cloud, the most frequently used 10 words were ‘supply’, ‘Australia’, ‘manufacturing’, ‘think’, ‘products’, ‘time’, ‘chain’, ‘company’, ‘need’ and ‘know’. As the word cloud shows, the main focus of this study was manufacturing, supply chains, Australia and products. These words were used most frequently, alongside words such as ‘think’, ‘mean’ and ‘example’, which demonstrate that the interview facilitator asked not only facts, but also opinions. Further, the word ‘time’ shows that, within the topic of manufacturing, time is crucial, and lead time is very important.



Other commonly used words were 'cost', 'Asia', 'stock', 'order', 'offshore', 'overseas', 'business', 'supplier', 'lead (time)', 'industry', 'price', 'flexible', 'flexibility', 'people', 'market', 'customer', 'production', 'inventory', 'management', 'material', 'quality', 'labour' and 'forecast'. These words are used every day in the manufacturing industry and are the most important terms when a leader has to manage and optimise all these core elements with the core activities to gain long-term competitive advantage.

## **Appendix VIII: Established Themes in NVivo-assisted Analysis (Less Relevant Themes)**

### **A.1 Implementing Continuous Improvement**

Five of the respondents (B, E, F, J and H) stated that they implemented continuous improvement through the manufacturing process. Through these activities, companies seek to ensure they are productive and cost-effective. One of the respondents (J) stated that they are focusing on quality management, ISO (International Organization of Standardization), preventive maintenance, customer focus and design reviews, while company F used supplier valuations, JIT and enterprise resource planning:

The operation is focusing on quality management, ISO, preventive maintenance, customer focus, design reviews. We also apply supplier valuations, JIT, ERP [enterprise resource planning] (I).

Most successful manufacturers around the world have been implementing these production and supply chain processes; however, in this study, only four out of 12 companies implemented these activities. Of the eight onshore companies, only four employed activities such as lean production, JIT, enterprise resource planning, vendor-managed inventory and so forth. Offshore companies do not have detailed information about production processes because most offshore production sites are controlled by the local management; therefore, the Australian management has minimal knowledge about production strategies.

In contrast to the above mentioned lack of awareness, Companies B and F stated that they worked hard to apply different types of production and supply chain techniques:

Yep, and no we're always doing those continuous improvement type activities to make sure that we're as productive as we possibly can. Where a lot of the problems are as our quantities, our quantity runs that have been ordered are a lot smaller now, so now set ups and make readies and that are a larger part of the manufacturing process for that job. Very hard to reduce the set up times on a lot of the machines (B).

Yep, no we're always looking for new processes, new products, new ways of trying to keep our costs down. So what works for one area may not work for another area (F).

Further to the idea of manufacturing and supply chain practice, one of the participant companies (H) stated that they needed to improve their forecast accuracy because, by giving more frequent and reliable forecasts, they could achieve a lot of savings on the inventory:

and we need to get better at our forecasts, which is something we are also working very hard on because we believe that we've made some massive improvements but we believe we, by giving on the forecast accuracy we can gain a lot on the inventory (H).

Inventory management and sharing demand forecast information is a crucial management strategy for an efficient operation and supply chain. However, in Australia, not all managers have the knowledge base to suggest and implement these practices. Further, it is also understood from the data analysis that most of the companies implemented a certain type of production or supply chain strategies, yet not the whole 'system'.

## **A.2 Implementing Lean Management and Other Production Strategies**

In this section, a pattern was established regarding the relevance of applying lean management to production. Lean management provides companies the advantage of producing with a smaller inventory, with quick changeovers and with continuous improvement to gain efficiency, ensure quality and save costs.

## **A.3 Quality of Products from Australia and Overseas**

There were only few responses about the quality of products. Company C reported that Asian products are usually lower quality than are Australian products:

Sometimes the stuff we get out of China there's problems around that, but it's a work in progress.

This manager also stated that they are able to produce in Australia because the quality of products built overseas is too low for their particular kind of product. Further, Companies G, B and H reported that materials from Australia are usually premium:

We have had a lot of companies who have purchased products that we make from overseas and they've then come back to us because the product they got from overseas was cheap and didn't work and our quality was a big area there. So I suppose a lot of that comes into play, the confidence from the Australian manufacturers is certainly there.

Company H also stated that they can supply most of their part or material requirements locally and they usually premium quality products. In contrast to the above, Companies B and H stated that, while Asian markets require improvements in certain areas, they are quick to improve quality and they learn rapidly. Of the 12 participant companies, five (A, B, H, E and F) implemented lean management in their production. In addition to lean production, three employed Kanban time processes, quick changeovers, statistical process control, six-sigma, value engineering and vendor certification. These processes and strategies should have been implemented in most production sites because effectiveness and cost reduction can be gained by applying these practices:

Yes we do, in our factory, we do some preventative maintenance, we do as much—we've got a few projects related to lean manufacturing, so that's something we are obviously looking at (B).

Obviously we need to get much more efficient in our factory to save some costs, so that's an ongoing work that we are doing (E).

The companies that implemented different production strategies were efficient; however, it seemed that not all of them implemented those strategies entirely or were aware of the full process; hence, they could not achieve the optimal result:

Dealing with the automotive industry, we've been trained or forced over the last 10 years to be as lean and as efficient as possible, so in some respects it's quite good in terms of the number of people and the amount of work that's generated is quite good. We're very lean in terms of not just manpower, but also our pricing and negotiating pricing and things like that (B).

In the above example, the manager (B) misunderstood the term of 'lean production'. Lean manufacturing does not originate from workforce management and price negotiation. Rather, lean management is an approach to operating an organisation that supports the

concept of continuous improvement. It is a long-term approach that systematically seeks to achieve small, incremental changes in processes to improve efficiency and quality.

Quick changeover (which is related to lean management) is also an important part of production when companies produce differentiated products:

What is critical is to make sure we are efficiently able to produce short runs and quickly changing between different types (F).

Of the 12 companies, five (B, J, I, F and E) reported that they used quick changeover and continuous improvement throughout their production. The other companies did not report applying lean management. The proportion of this activity related to the whole sample shows again that fewer manufacturers implemented those activities than anticipated.

## Appendix IX: Online Survey Questions

1	Please briefly describe your company's main manufacturing sector				
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2	How large is your company? (number of employees)	<b>1–49</b>	<b>50–199</b>	<b>200–999</b>	<b>1,000–10,000</b>

3	Please specify the location of your manufacturing site/s (you can select more than one answer)	<b>Australia</b>	<b>Asia</b>	<b>Europe</b>	<b>North America</b>
		<b>South America</b>	<b>Africa</b>		

4	My organisation is a mass manufacturer where our products are standard (the products of my company do not have significant elements of customisation)	<b>Yes</b>	<b>No</b>

5	The products of my company are complex, allowing for many variations in the finished product, and customer demand is unpredictable	<b>Yes</b>	<b>No</b>

6	The proportion of raw materials, parts or finished products that my organisation sources from overseas is:	<b>Less than 20%</b>	<b>20–39%</b>	<b>40–59%</b>	<b>60–79%</b>
		<b>80–100%</b>			

7	Sharing demand and forecast information with suppliers and distributors weekly or daily is important	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>

8	My organisation is experiencing demand uncertainty in the market	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>

9	My organisation has transportation and lead time problems when obtaining raw materials or finished goods from overseas	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>

10	My organisation has transportation and lead time problems when obtaining raw materials or finished goods from overseas	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>

11	My organisation is able to remain in Australia because we have a niche market in	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
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	Australia				
12	My organisation is able to remain in Australia because we apply flexibility and agility in our everyday activity	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
13	The production of my company moved overseas because of price competition	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
14	The production of my company moved overseas because we entered a different market	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
15	Although several Australian manufacturers are following the trend to move offshore, many do not calculate the unexpected, hidden and invisible costs of offshore operation	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
16	Australian manufacturers are following the trend to move offshore, instead of trying to apply successful operation, management or supply chain strategies	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
17	Manufacturers in Australia are not investing enough in asset and knowledge building	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
18	There is a lack of investment from the government into Australian manufacturing	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
19	Standard products that are produced in large numbers (bulky goods, mass production) can be produced more effectively in Asia, but products that are more customised and need to be delivered quickly can be more effectively produced locally	<b>Strongly agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly disagree</b>

## Appendix X: Summary of the 12 ‘Topic Questions’ Responses in Online

### Survey

